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JUL 30 1948

Plating

THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY

JULY-1948 Volume 35 No. 7

In this issue:

Better Deposits at Greater Speeds by P R Plating

Notes on the Prevention of White Powder Corrosion of Cadmium Plate

Some Metallurgical Aspects of Electrodeposits: Part 2

Adhesion of Electrodeposits

Convention News

Complete contents on page 705

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The CLEPO Way

Reduce POLISHING and BUFFING costs

by Proper Surface preparation with the NEW

CLEPO PRE-BUFFING PROCESS

CLEPO — CLEANING COMPOUNDS

The Clepo Pre-Buffing Process removes all oil, grease, and oxides present on certain base metals and treats the metal surface so that the surface flows easily when the buff wheel is applied against it. The exact procedure to use, varies with the type of base metal, and these various procedures are outlined in the following flow chart.

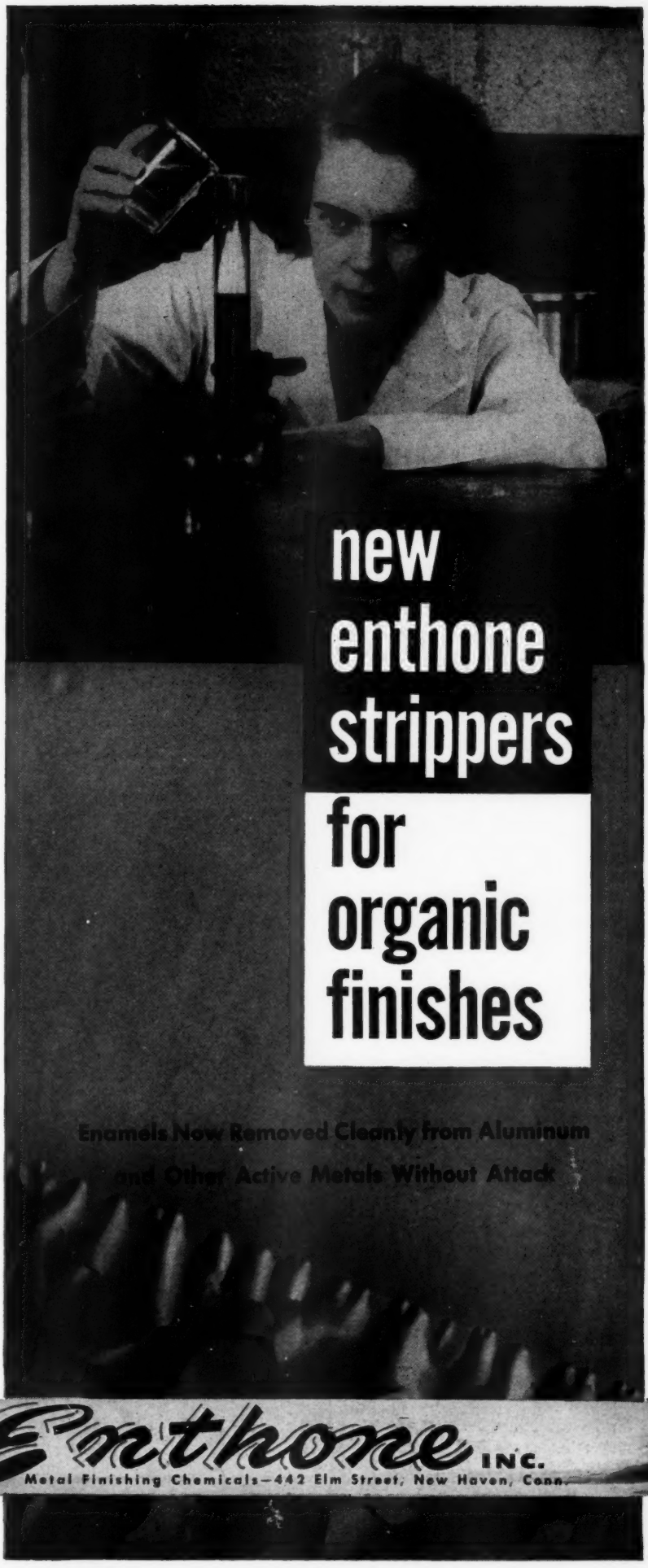
OPERATION NUMBER	TYPE OF BASE METAL BEING TREATED				
	COPPER	BRASS	NICKEL-SILVER	WROUGHT ALUMINUM ALLOYS	ZINC BASE DIE CASTING
1	CLEPO 36-K	CLEPO 36-K	CLEPO 36-K	CLEPO 85-D	CLEPO 85-D
2	C.W.R.	C.W.R.	C.W.R.	C.W.R.	C.W.R.
3	CLEPO 181	CLEPO 181	CLEPO 181	CLEPO 180-K	CLEPO Z.D.A.
4	C.W.R.	C.W.R.	C.W.R.	C.W.R.	C.W.R.
5	H.W.R.	H.W.R.	H.W.R.	H.W.R.	H.W.R.

We will be very glad to finish samples in our laboratory using the Clepo Pre-Buffing Process and return for your inspection and tests.

FREDERICK GUMM Chemical Company Inc.

538 FOREST STREET, KEARNY, N.J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 471.


new enthone strippers for organic finishes
Enamels Now Removed Cleanly from Aluminum and Other Active Metals Without Attack

new strippers

are available even more powerful than Enthone Regular Enamel Stripper which has been used by industry for the past fifteen years. These new strippers include:

stripper S-15:

For stripping nitrocellulose lacquers.

stripper S-17:

volatile room temperature stripper for removing heavy coatings from work holders, hooks and production work.

stripper S-19:

A powerful quick evaporating room temperature stripper for clear and pigmented synthetics.

stripper S-45:

A brush-on, thickened spot enamel stripper for synthetics.

stripper P:

A stripper mixed with water to form a clear dispersion that strips alkyd, ureaformaldehyde and melamine synthetic enamels.

stripper S-300:

An emulsion stripper that mixes clearly with water for fast stripping of synthetic enamels from all metals.

stripper WS-70:

A quick evaporating stripper for removing enameled coatings from wire.

Also special strippers for specific problems.

For fifteen years Enthone chemists have specialized in development of strippers for organic finishes. Take advantage of their experience and send samples of your products to them for stripping advice.

Enthone INC.
Metal Finishing Chemicals—442 Elm Street, New Haven, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 472.

Industry News

D. D. Foster Co. of Pittsburgh, Pa., has been appointed representative for western Pennsylvania, Ohio and West Virginia of The General Ceramics and Steatite Corp., Keasbey, N. J.

The D. D. Foster Company is now prepared to offer equipment fabricated of chemical porcelain, chemical stoneware, and impervious graphite, to the processing plants in its territory.

Mathieson Expands in the South. A new southern sales area, with headquarters at New Orleans, has been announced by D. W. Drummond, Vice-President-General Manager of Sales of Mathieson Chemical Corporation (formerly The Mathieson Alkali Works). Vernon Woodside, formerly a member of the Sales Development and Technical Service Department, will be in charge of the New Orleans sales district. He will make his headquarters in a branch office being established in the Queen and Crescent Building, 344 Camp Street, New Orleans, La.

Philadelphia Quartz Company, manufacturers of silicates of soda, has announced the removal of its General Offices from 121 S. 3rd Street, Philadelphia, where they have been located for almost a half century. On August 2, 1948, the offices will be in the Public Ledger Building, Independence Square, Philadelphia. The Company is to occupy the office space on the eleventh floor of the building.

This month marks also the completion of 117 years of business for the Quartz Company. It was started by Joseph Elkinton as a soap and candle manufactory in Philadelphia on July 21, 1831. Early in the '60's, the Elkintons produced silicate of soda for their own soaps and soon after for other soap manufacturers.

The Philadelphia Quartz Company name was first used in 1864 when a new plant was built for producing silicate of soda. Soap and silicates continued to be manufactured until 1904, when silicates became the exclusive products of the Company. To supply the needs of the diversified fields, the Company operates plants at Chester, Pa.; Anderson, Ind.; Baltimore, Md.; Gardenville, N. Y.; Jeffersonville, Ind.; Kansas City, Kans.; Rahway, N. J.; St. Louis, Mo., and Utica, Ill.

Associated companies are the Philadelphia Quartz Company of California with plants located at Berkeley and Los Angeles, Calif., and Tacoma, Wash., and the National Silicates Limited, Toronto, Ontario, Canada.

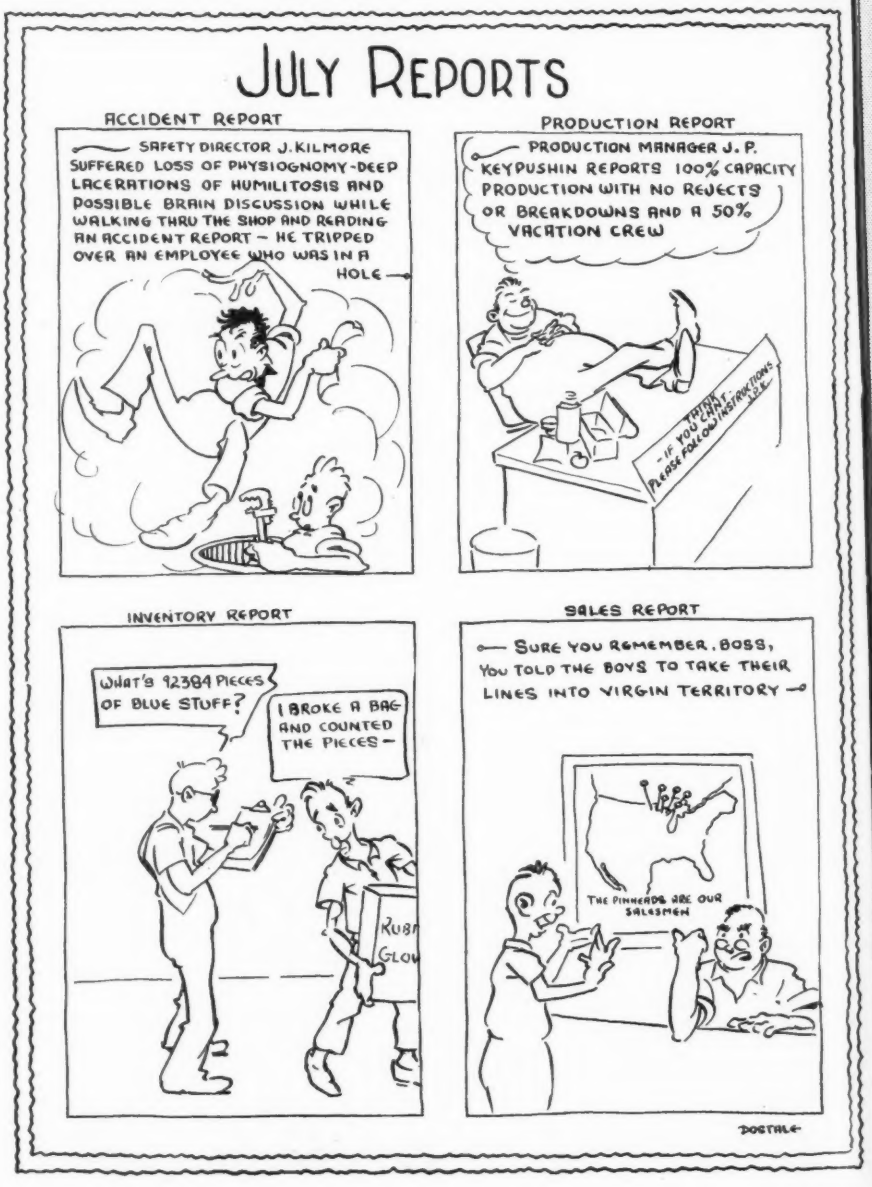
Frankford Arsenal Ordnance Laboratory, comprising the chemical, metallurgical, mechanical development, and ballistic branches, has been designated the Pitman-Dunn Laboratory as of 10 March, 1948.

This new official designation has been made to memorialize the distinguished services and scientific efforts of two Ordnance Officers, Captain John Pitman and Captain Beverly W. Dunn, who were largely responsible for establishing the Laboratory at this Arsenal over half a century ago.

The Bullard Clark Company has been formed as a result of a consolidation of the E. H. Jacobs Manufacturing company with its three affiliated companies, The E. H. Jacobs Manufacturing Corporation of Charlotte, N. C., The Williamsville Buff Manufacturing Company of Danielson, Conn., and Jacobs Rubber Products, of Danielson, Conn.

The Williamsville Buff Division was organized in 1898 by the Williamsville Cotton Mills of Connecticut which was purchased by W. Irving Bullard and Frederick A. Jacobs in 1905. The buff business was retained by the Jacobs Company and the cotton mill was re-equipped with tire fabric machinery and sold to the Goodyear Tire and Rubber Company of Akron, Ohio. The buff division uses over one and a half million yards of sheeting per year for the manufacture of buff wheels and is also a large producer of polishing wheels made of canvas and leather for polishing heavy machinery and hardware.

Electrochemical Industries, which specializes in the plating on plastics, has its headquarters at 45 Spruce St. Leominster, Mass., and not in Holyoke as indicated in Convention News write-up in the May issue.


JULY REPORTS
ACCIDENT REPORT
SAFETY DIRECTOR J. KILMORE SUFFERED LOSS OF PHYSIOGNOMY-DEEP LACERATIONS OF HUMILITOSIS AND POSSIBLE BRAIN DISCUSSION WHILE WALKING THRU THE SHOP AND READING AN ACCIDENT REPORT – HE TRIPPED OVER AN EMPLOYEE WHO WAS IN A HOLE
PRODUCTION REPORT
PRODUCTION MANAGER J. P. KEYPUSHIN REPORTS 100% CAPACITY PRODUCTION WITH NO REJECTS OR BREAKDOWNS AND A 50% VACATION CREW
IF YOU CAN'T PLEASE FOLLOW INSTRUCTIONS HERE
INVENTORY REPORT
WHAT'S 12384 PIECES OF BLUE STUFF?
I BROKE A BAG AND COUNTED THE PIECES –
SALES REPORT
SURE YOU REMEMBER, BOSS, YOU TOLD THE BOYS TO TAKE THEIR LINES INTO VIRGIN TERRITORY –
THE PINHEADS ARE OUR SALESMEN
DOSTALE

Belke
TIME-SAVER
PLATING RACKS

Section of BELKE Rack with Auxiliary Anode for Chromium Plating shower spray parts. Three point contact tips hold part in correct relation to Auxiliary Anode, assuring uniform chrome deposit on inside surface. Racking and unracking are fast and easy.

For High Plating Efficiency

Efficient racking saves you plenty! Gives you bigger production—and better plating results with less handling. That is why BELKE Experience, BELKE Know-How and BELKE Facilities put extra value beyond measure into plating racks.

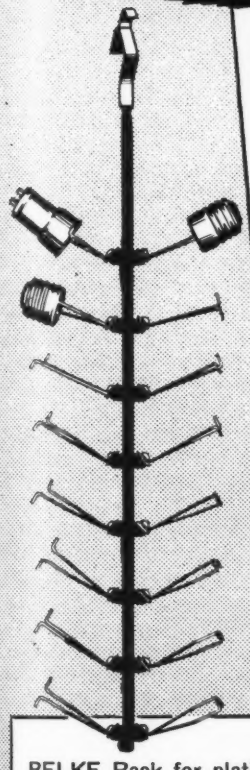
For example, BELKE Methods of applying Modern Rack Insulations make it possible to run work thru the entire cleaning and plating cycle with but one racking. *Think of it! Racks that stand up in copper, nickel, chrome, cadmium, zinc and all other plating and cleaning solutions, including tri-chlorethylene degreasing.*

BELKE Experience and Specialized Facilities are available to provide the exact insulation best suited for your needs.

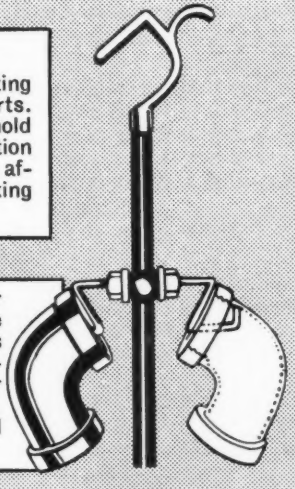
Whatever your racking requirements, just send specifications with dimensional sketch or sample part for the BELKE Recommendation.

The Most Complete Rack Manual Ever Produced

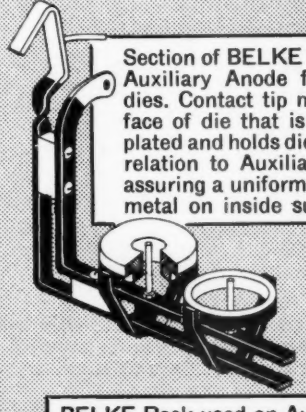
100 pages of experience-proved information. Practical construction methods. Insulations. 560 Proven Designs of Racks, Tips and Hooks. 144 illustrations of Racking Methods—shows how to rack all shapes and sizes from jewelry to bumper bars. Price $5.00 postpaid.



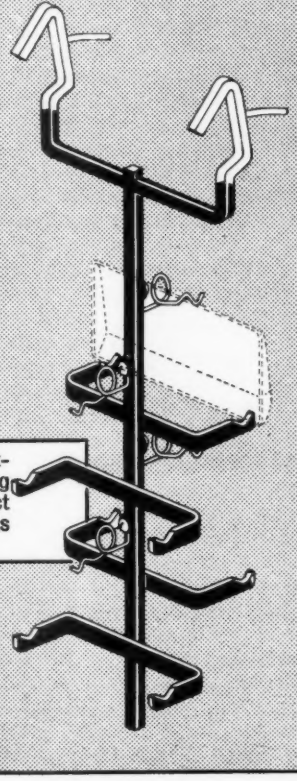
BELKE Rack for plating electrical socket parts. Spring contact tips hold parts in correct position for good drainage and afford fast and easy racking and unracking.



BELKE Rack for plating water pipe elbows. Special tips hold elbows in correct position for good drainage Racking is fast and easy.



Section of BELKE Rack with Auxiliary Anode for plating dies. Contact tip masks surface of die that is not to be plated and holds die in correct relation to Auxiliary Anode, assuring a uniform deposit of metal on inside surface.



BELKE Rack used on Automatic Plating Machine for Chromium Plating Broiler Covers. Cover is held in correct position for good drainage and gas elimination.

BELKE MANUFACTURING COMPANY

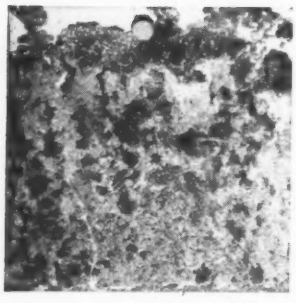
947 North Cicero Ave Chicago 51, Illinois

EVERYTHING FOR PLATING PLANTS

FOR FURTHER INFORMATION, USE READER SERRICE CARD; INDICATE A 473.

Alodize Aluminum

FOR THE UTMOST IN METAL AND FINISH PROTECTION



ALKALI CLEANED
500 HOURS S. S.

Comparative salt spray test on 24St aluminum. Both panels were finished with one coat of baked refrigerator white enamel. Notice that after only 500 hours the paint system on the alkali-cleaned panel is almost entirely destroyed and the aluminum itself is badly corroded. In contrast, the paint finish is still intact on the Alodized panel after 2000 hours' exposure.

ALODIZED
2000 HOURS S. S.

The Coating

"Alodine" produces a thin, tough, tight, skin-like coating firmly embedded in the aluminum. This protective skin is extremely resistant to corrosion and bonds paint firmly to the metal for the life of the finish.

CHEMICALS ACP PROCESSES

RUST PROOFING AND PAINT BONDING
Granodine *
Duridine *
Alodine *
Litheform *
Thermoil-Granodine *

RUST REMOVING AND PREVENTING
Deoxidine *
Peroline *

PICKLING ACID INHIBITORS
Rodine *®

The Process

Alodizing is simple, quick, economical, easy to operate and effective. "Alodine" can be applied by immersion, spraying, or brushing. It can be utilized to advantage in your own production. Write or call for the new descriptive folder on "Alodine".

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

Industry News

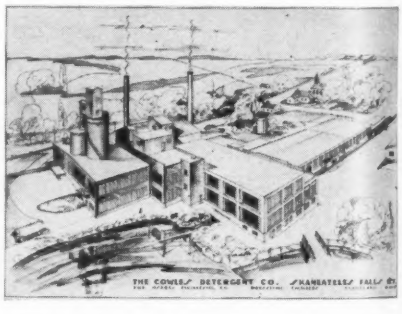
The new officers of The Bullard Clark Company are:

W. Irving Bullard, Chairman of the Board of Directors
Edward J. Bullard, President and Treasurer
B. T. Clark, Executive Vice-President
J. D. Lodge, Vice-President and Secretary
J. E. Moe, Vice-President

The General Manager of the Williamsville Buff Division is Jack D. Lodge.

The Cowles Detergent Company, Cleveland, Ohio, announces the completion of a new million dollar plant at Skaneateles Falls, New York. One of the most modern chemical plants in the country, it is equipped with up-to-date equipment for the manufacture, packaging and shipping of the Cowles line of heavy chemical detergent silicates as well as the Company's line of specialized detergents for the metal cleaning and other fields.

The Company's plants at Lockport, N. Y., and Sewaren, N. J., are operating at capacity. The addition of the new plant at Skaneatales Falls, where operations have already commenced, makes it possible for the Company to expand production to the point where deliveries can be effected more promptly and in increased quantities. It also enables



Cowles to expand sales in the industries now served as well as reach new markets not previously touched.

Beckman Instruments Now Factory-Serviced in Chicago. In order to facilitate the servicing of the great number of Beckman Instruments in use throughout the Eastern and Middle Eastern areas, National Technical Laboratories, manufacturers of Beckman Instruments, has established its own factory servicing headquarters at 9 S. Clinton Street, Chicago, Ill. George R. Kinkaid,

Published monthly at 5800 N. Mervine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1948, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

REALIZE Greater Profits with the REAL-VENT Non-Fray Ventilated Buff

The REAL-VENT Closed Face Non-Fray Ventilated Buff

The REAL-VENT Open Face Non-Fray Ventilated Buff

The REAL-VENT Non-Fray Ventilated Buff is made under patent Nos. 2,027,863; 2,094,650; 1,573,961; Re. 19,894; 2,140,208, other patents pending

The CENTER of Attention

CODMAN'S new REAL-VENT Non-Fray Ventilated Buff can help you cut down production costs and increase profits in these ways:

GREATER VENTILATION

Greatly increased ventilation, made possible by deeper and stronger ventilating channels in the "center of attraction," keeps the REAL-VENT cool. Cool buffs work longer and harder.

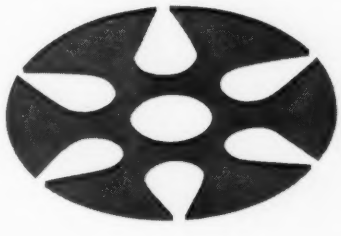
GREATER DENSITY

The thin "center of attraction" of the REAL-VENT makes it possible to group buffs for a *denser, fully ventilated face. Greater density promotes greater shop production.

LONGER LIFE and GREATER WEAR

The rock-like formed "center of attraction" of the REAL-VENT Buff, although thinner than ever before, can stand great tightening pressures without twisting, buckling or compressing. Longer life means reduced buff costs.

*If a softer face is desired, ventilating spacer discs, illustrated at right, are available.



It will pay you to explore the profit-making possibilities offered by the revolutionary new REAL-VENT Non-Fray Ventilated Buff. An inquiry addressed to us will get prompt attention.

THE MARK OF QUALITY

BUFFING AND POLISHING WHEELS FOR EVERY OPERATION

F.L.&J.C. **CODMAN** COMPANY

ROCKLAND · MASSACHUSETTS

BRANCH OFFICES: DETROIT, LOS ANGELES PHILADELPHIA GRAND RAPIDS

For Over Fifty Years the Greatest Name in Buffs

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 475.

THE Siefen System*

SPRAY EQUIPMENT
SPRAY COMPOUNDS
SPRAY SERVICE

*** "The Siefen System" is rapidly becoming a familiar term for the fast, efficient and economical way of applying buffing and polishing compound to revolving wheels.**

"The Siefen System" for spraying compounds is—

FAST—better cutting and coloring
EFFICIENT—no work stoppage
ECONOMICAL—save over 60%

PROPER SPRAY EQUIPMENT

SIEFEN has developed through experience, efficient spray guns, operating valves, hose and fittings, baffles, circulating pumps, pressure tanks or gravity cups for hand or automatic operation.

BUFFING AND POLISHING SPRAY COMPOUNDS

SIEFEN liquid compounds, either grease and abrasive or glue and abrasive, eliminate guesswork and really reduce costs.

EXPERIENCED SPRAY SERVICE

SIEFEN specialists, all over the country are ready to give you the latest, most up-to-date help and recommendations for improving speed and quality, increasing efficiency and cutting production costs.

J. J. SIEFEN COMPANY
5635 LAUDERDALE • DETROIT 9, MICHIGAN

Industry News

Mid-Western Representative for National Technical Laboratories, is in charge.

The new Chicago Service and Repair Department is staffed with factory-trained specialists and features the latest equipment for servicing and repairing Beckman pH Meters, Spectrophotometers, Radiation Meters, Glass Electrodes and many other Beckman precision control instruments.

The Electroplating Institute of America, Pittsburgh, Pa., was organized in July, 1947 to provide training in the science of electroplating.

The school is under the executive management of Richard J. Zaiden, who is also president of the Pittsburgh School of Plastics, the Commercial Institute, both of Pittsburgh, and the Technician Training School of Uniontown, Pa. Dr. Leslie E. Lancy, noted engineering consultant in the field, is technical director. He is assisted by an Advisory Board of experts from local organizations, among which are William J. Hennessy, Pennsylvania Salt Manufacturing Company; Frank B. Keller, Standard Steel Spring Company; Edwin J. Smith, Weirton Steel Corporation; Arthur F. Kaupe, J. D. Patrick, and A. K. Mock, Westinghouse Electric Corporation; G. A. Jersey, Air Tool Parts and Service Company; Richard A. Dimon, Carnegie-Illinois Steel Corporation; Edward M. Washburn, McKinney Manufacturing Company; Joseph E. and Albert R. Bugel, East Liberty Electroplating Company; and W. B. Williams, Industrial Lining Engineers.

Electroplating I is designed especially for students desiring general training in both theory and shop practice. This course is either a full-time resident course of nine months' duration comprising twenty-five clock hours per week or a half-time night course, which is set up especially for persons employed during the day, of eighteen months' duration comprising twelve clock hours per week.

Electroplating, Industrial, arranged solely for personnel employed in the plating and allied fields, is offered two nights per week to those desirous of advancing their technical knowledge and, thereby, enhancing their value to themselves and to industry. The classes are conducted by experts from leading local corporations.

All courses are approved by the Pennsylvania Department of Public Instruction and by the Veterans Administration for the training of both veterans and non-veterans alike. They do not require a high school diploma for enrollment.

The first class in Electroplating I was graduated on April 15, 1948, and every student was placed almost immediately This is attributed, in a large measure, to the fine cooperation prevailing between the school and industry.

It's NEW!

and superior by every standard of comparison . . . and costs less!

MICCROSOL

E-1003

HEAT-CURED RACK COATING

- Now, the MICCRO laboratories have developed a single-dip heat-cured rack coating that offers, in addition to positive insulation and protection: (1) amazing tensile strength and scuff resistance, (2) permanent flexibility, (3) positive and continuous adhesion, (4) simplicity of application, (5) savings in time, labor, and material . . . a major objective of chemical engineers for years. This new coating is MICCROSOL E-1003.

- MICCROSOL E-1003 is the exclusive product of Michigan Chrome and Chemical Company, developed and manufactured in our own plant with the same technical skill and knowledge that has made all MICCRO products outstanding in the plating industry.

- Look at the chart! This exhaustive test analysis reveals the marked superiority of MICCROSOL E-1003 in every important factor of comparison. In addition, tests for abrasion and resistance to all commonly used plating solutions, acids, and caustics show equally amazing results.

- MICCROSOL E-1003 is a 100% solids non-evaporating material that produces a smooth, tough, leather-like coating with a single application that will often outlast the life of the rack. Racks are completely processed and ready for use in approximately 2 to 4 hours.

- For further information write for detailed bulletin on Miccrosol E-1003.

YOU ASK FOR FIGURES? HERE THEY ARE!

Comparison of MICCROSOL E-1003 with three other well-known coatings.

Tests	Miccrosol E-1003	Coating A	Coating B	Coating C
Tensile Strength	3400#	2600#	2000#	1600#
Adhesion	125#	40#	25#	35#
Hardness Durometer "A"	80-85	70	52	50
Tear Strength	650#	450#	350#	250#
Elongation	250%	350%	400%	450%
Recovery	99%	99%	99%	100%
Solids	100%	100%	100%	100%

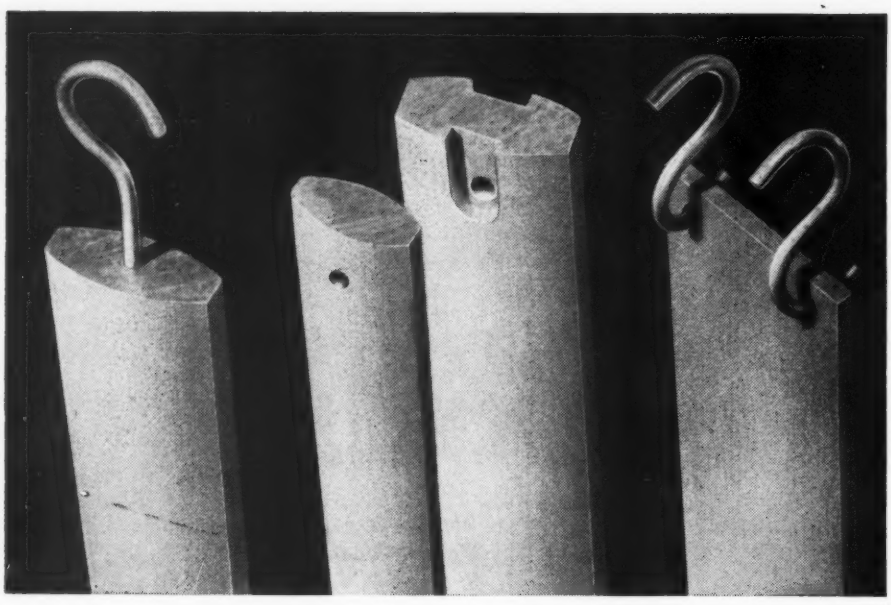
MICHIGAN CHROME
and Chemical Company

6351 East Jefferson Avenue • Detroit 7, Michigan

MICCRO Products

Developed and Manufactured by Experienced Platers

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 477.



Anaconda

MEANS PURITY IN COPPER ANODES

WHEN YOU SPECIFY ANACONDA, you are assured of unexcelled purity... less than 0.01 percent of total metallic impurities... an advantage that pays off five ways:

1. **Copper goes into solution faster and more uniformly.**
2. **The highest quality deposit is produced in the shortest possible time.**
3. **Slime is reduced to an absolute minimum.**
4. **Spotting and discoloration of the deposit are minimized.**
5. **Scrap losses are exceptionally low.**

In addition to copper, Anaconda Anodes are furnished in brass and bronze... rolled Sheet or Oval... cut to your own specifications or standard sizes... drilled or undrilled... with or without hooks—also "cathode-anodes." For present or future reference, write for Publication C-5. 47272-A

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Industry News

The McAleer Manufacturing Company, Ltd., Chatham, Ontario, Canada, in which the Roberts Rouge Company of Stratford, Conn., has purchased a substantial interest, has elected Theodore F. Onkey President.

Because of the austerity program and conservation of Canadian funds, many substantial Canadian accounts purchasing buffing compounds from the local firm have curtailed their purchases. By combining interests, formulae and know-how of Roberts Rouge Company with those of McAleer Manufacturing Company a complete line of Roberts Buffing and Finishing Compounds will also be produced in Canada.

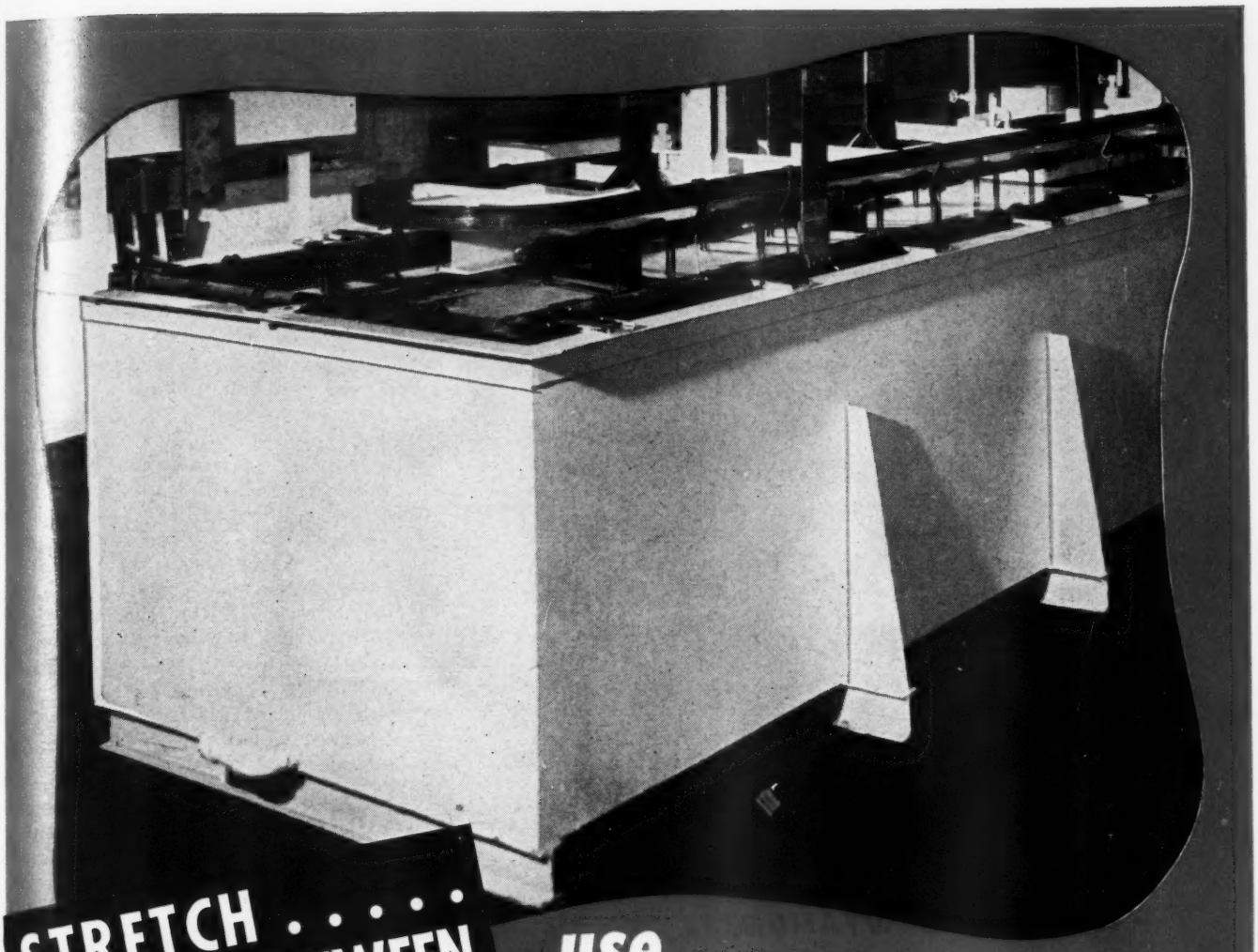
Turco Products, Inc., Los Angeles, Chicago, and Houston, recently assembled District Managers for two-day home office conference with laboratory technicians and department heads.

A review of the adaptations and application of new wetting agents and detergents to its line of specialized cleaning ompounds was the principal theme of these sessions. District Managers will, in turn, hold similar meetings with their field service organizations.

Rate of Job Shop Operations in Metropolitan New York. According to the Monthly Bulletin of the Masters' Electroplating Association, 123 William Street, New York 7, N. Y., rate of operation averaged 49 and 50 per cent during April and May respectively, the lowest on record since such data were first collected in January, 1939. The corresponding figures for 1947 were 58½ and 57½ per cent respectively.

Metalcraft Engineering has moved to its new and larger quarters located at 230 Verona Avenue, Newark 4, N. J., and has installed equipment and materials for metal finishing by mass tumbling or Honing. It is also exclusive distributors for eight states in the East for Honite, Super Honite and Compounds, manufactured by the Minnesota Mining and Manufacturing Company and also for Almco tumbling equipment manufactured by the Almco Division of Queen Stove Works of Albert Lea, Minnesota.

Platinum Chemicals, a new laboratory which will have for its purpose the assaying and refining of gold, silver, and the metals of the platinum group and the manufacture of salts of the precious metals to specifications, has just been established according to an announcement made by Mr. Herbert E. Zschiegner. It is located at 154 Paris Street, Newark 5, N. J.



STRETCH . . . . . THE TIME BETWEEN REPAINTING

use . . . TYGON PAINT

IN FULLY 90% of the cases where corrosive gases, acid spillage, or condensation necessitate frequent repainting of buildings and equipment, Tygon Paint will stretch the time between repaintings anywhere from two to ten times.

A broad statement, true; but it is backed by the proven experiences of several thousand Tygon Paint users.

Tygon Paint is a liquid solution of modified vinyl plastics. Applied like an ordinary paint to metal or concrete, it air dries quickly to form a tough, impermeable, flexible plastic film—corrosion-resistant, impact resistant, time-resistant.

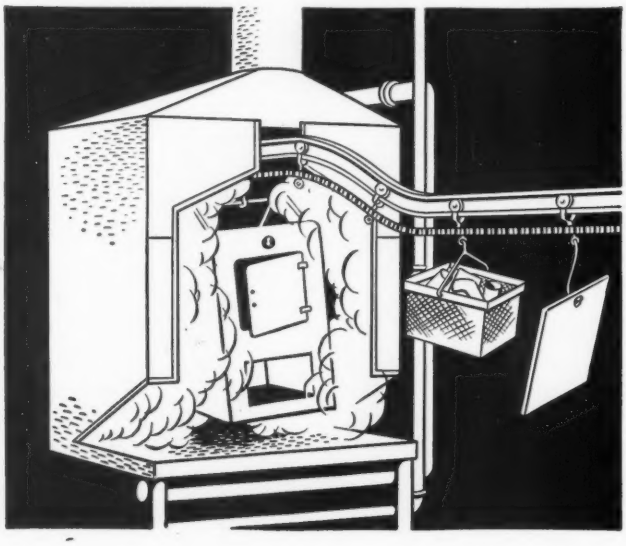
Completely told in Bulletin 709 free on request. Or, better yet, why not order a trial Tygon Kit: 1 quart Tygon Primer, 1 quart Tygon Top Coat (specify color desired: gray, black, clear, green, white or aluminum) and 1 pint Tygon Thinner $6.00, prepaid.

PLASTICS & SYNTHETICS DIVISION

U. S. STONEWARE

Akron 9, Ohio

PARTS CLEAN
SOLUTION CLEAR



THANKS TO WYANDOTTE MK-50 SOLVENT DETERGENT

WYANDOTTE MK-50 is without an equal as an emulsion cleaner. It may be used with or without alkalies in pressure-type metal parts washing machines—also as an additive to drawing, cutting, grinding and slushing oils and compounds to facilitate their removal after metal processing.

As a solvent detergent, MK-50 is used primarily in spray-type washing machines for cleaning parts between machining operations and prior to inspection, painting, etc.

It rinses quickly and thoroughly and leaves no harmful salts on the metal surface. It is a neutral product and *does* leave a very light film on the metal which serves as a temporary rust inhibitor. This film helps bond any paint, enamel or lacquer finish.

MK-50 helps keep the washing solution clear, too. In the metal parts washing machine, it will throw out the absorbed oils and grease, so that they may be held on the surface of the sump or overflow section of the washer. This leaves the main body of the solution relatively clear.

Your Wyandotte Representative will be glad to tell you more about Wyandotte MK-50 and other Wyandotte Metal Cleaners. He's only a telephone call away.

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Personals

Joseph B. Kushner, well known consulting electro-chemist and metal finishing engineer, has completed plans for a new electroplating laboratory to be built at Stroudsburg, Pa., in the next few months. The laboratory will be devoted to research and development work in electroplating, electroforming and electrophoresis techniques. Mr. Kushner will continue, however, to maintain his consulting office at 233 W. 26th St., N. Y. 1, N. Y., for the convenience of his Greater New York and New England clients. Mr. Kushner, a chemical engineering graduate of the Cooper Union Institute of Technology and a graduate student of advanced electrochemistry and chemical engineering from Brooklyn Polytechnic Institute, has been intimately connected with the electroplating industry since 1933. During the war he held an important post with the Columbia University Division of the Manhattan Project and was awarded a bronze plaque for his services.

H. J. Sandstrom has been appointed Sales Representative for portions of Maine, New Hampshire, Massachusetts, Vermont, and Rhode Island by the American Buff Company, 2414 S. La Salle Street, Chicago, Ill.

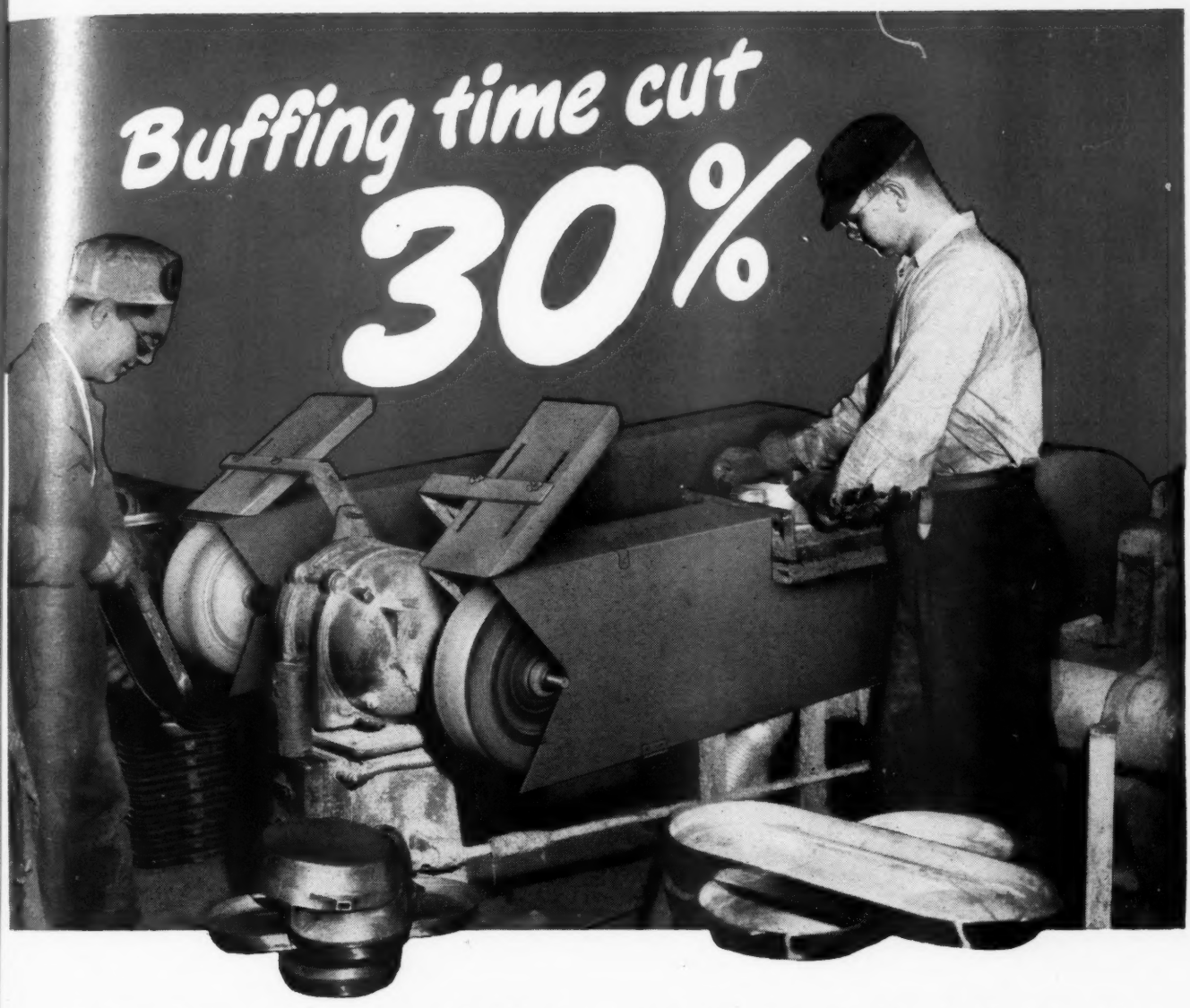
An overseas veteran of World War I, he merchandized foods between wars.

Sandstrom

During World War II he held a responsible position as expeditor of materials for anti-aircraft guns. Since then he has been engaged in the machine parts business. Mr. Sandstrom is married, and is the father of two daughters, nineteen and fifteen.

Paul F. Hoglund, formerly Resident Chemist for the Electroplating Section of E. I. du Pont de Nemours & Company, Inc., in Cleveland, Ohio, is now with that firm's Grasselli Chemicals Department in Grasselli, N. J.

Dr. D. P. Morgan has joined the Mathieson Chemical Corporation, formerly The Mathieson Alkali Works, as Administrator of Research and Development. He will be in charge of market research as well as chemical research and develop-



The manufacturer of these die-cast aluminum cooking utensils is enthusiastic about results since switching to 3M Abrasive Belts. The smooth, evenly blended finish secured requires 30% less buffing to produce a sparkling polish. The results are faster production, fewer rejects and lower finishing costs per unit.

This manufacturer, and countless others like him, are lowering production cost with 3M Abrasive Cloth Belts and Contact Rolls. Because of the broad experience gained by the 3M Company and its representatives in pioneering abrasive belt grinding . . . the wide variety of 3M Belts and Contact Rolls developed to meet the varying needs of industry, each 3M installation is *engineered* to fit the particular job to be done. No matter whether the surface to be ground is flat or contoured; cast, stamped or forged, there is a 3M *engineered* method to produce the finest possible finish in the shortest possible time.

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Personals

ment. For the past two years he has been with W. R. Grace and Company in New York in charge of chemical market research and development.

Dr. Morgan was graduated from Harvard University in 1916 and received his Ph.D. degree in chemistry from Columbia University in 1923. He was a partner in the firm of Loomis, Stump and Banks, consulting chemical engineers, for four years before joining Scudder, Stevens and Clark as chemical consultant. For the last several years of the war he served as Director of the Chemicals Bureau of the War Production Board.

William B. Chase has been appointed to the sales staff of the Zapon Division, Atlas Powder Company, as a representative in the Boston area.

Mr. Chase, for the past two years with Haynes Laboratories as a Sales Representative, is a resident of Ipswitch, Mass. During the war he served as Lt. Commander aboard the aircraft carrier "Enterprise". Prior to that he was with Uxbridge Worsted Company of Massachusetts, and in 1937 graduated from Harvard with an A.B. degree.

R. W. Helmig has been elected Vice-President and Director of the Electric Products Company, Cleveland, Ohio, manufacturers of battery-charging equipment, electrolytic equipment, synchronous motors and other specialty equipment. He joined the company in December, 1944. Previously, he was connected with Delco Products Corporation, Commercial Investment Company, W. W. Sly Manufacturing Company and owned The Planefilm Corporation.

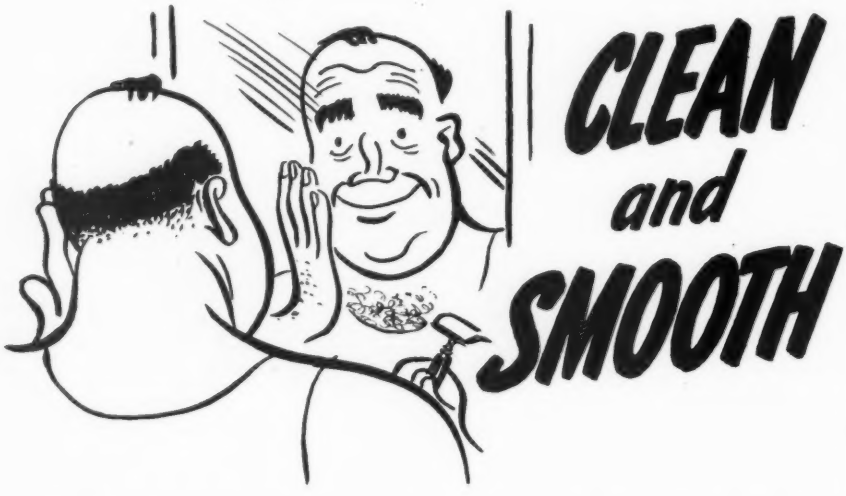
Helmig

The election of R. W. Helmig reflects the company's policy of selecting executive personnel from men active in production and manufacturing methods.

John M. Davidson has been named Pittsburgh District Sales Representative for the Special Chemicals Division of the Pennsylvania Salt Manufacturing Company. He formerly was Sales Representative in the Northern New Jersey and New York City territory and fills the post formerly held by William J. Hennessy, now Pittsburgh District Sales Manager of the Special Chemicals Division.

Mr. Davidson graduated from Dickinson College with a B.A. degree and earned a degree of M.Educ. at Temple University. Prior to joining Pennsalt in July 1946, he taught in high schools in Clayton, N. J., Pitman, N. J., and New York Military Academy, and was a salesman for the Ediphone Company, Philadelphia.

G. Klinkenstein, formerly Vice-President and General Manager, has been elected President of Maas & Waldstein Company, manufacturers of specialized production finishes. He has been with the company since 1915 starting as a chemist in the Nitrocellulose Plant. In 1922 he became Chief Chemist and in 1928 was advanced to Technical Director. Mr. Klinkenstein was elected Vice-President and General Manager in 1936. Under his supervision, and also as a result of his own researches, the number of Maas & Waldstein Company products expanded from just a few clear metal lacquers to a complete line of industrial finishes to meet practically every need.



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In this cleaning process, the oils and greases are dissolved by BLACOSOLV, the efficient degreasing solvent which can be used on all metals or combinations of metals. BLACOSOLV is non-inflammable and non-explosive. It can be heated, without danger of any fire hazard. Just one solvent at one price will do the complete degreasing job.

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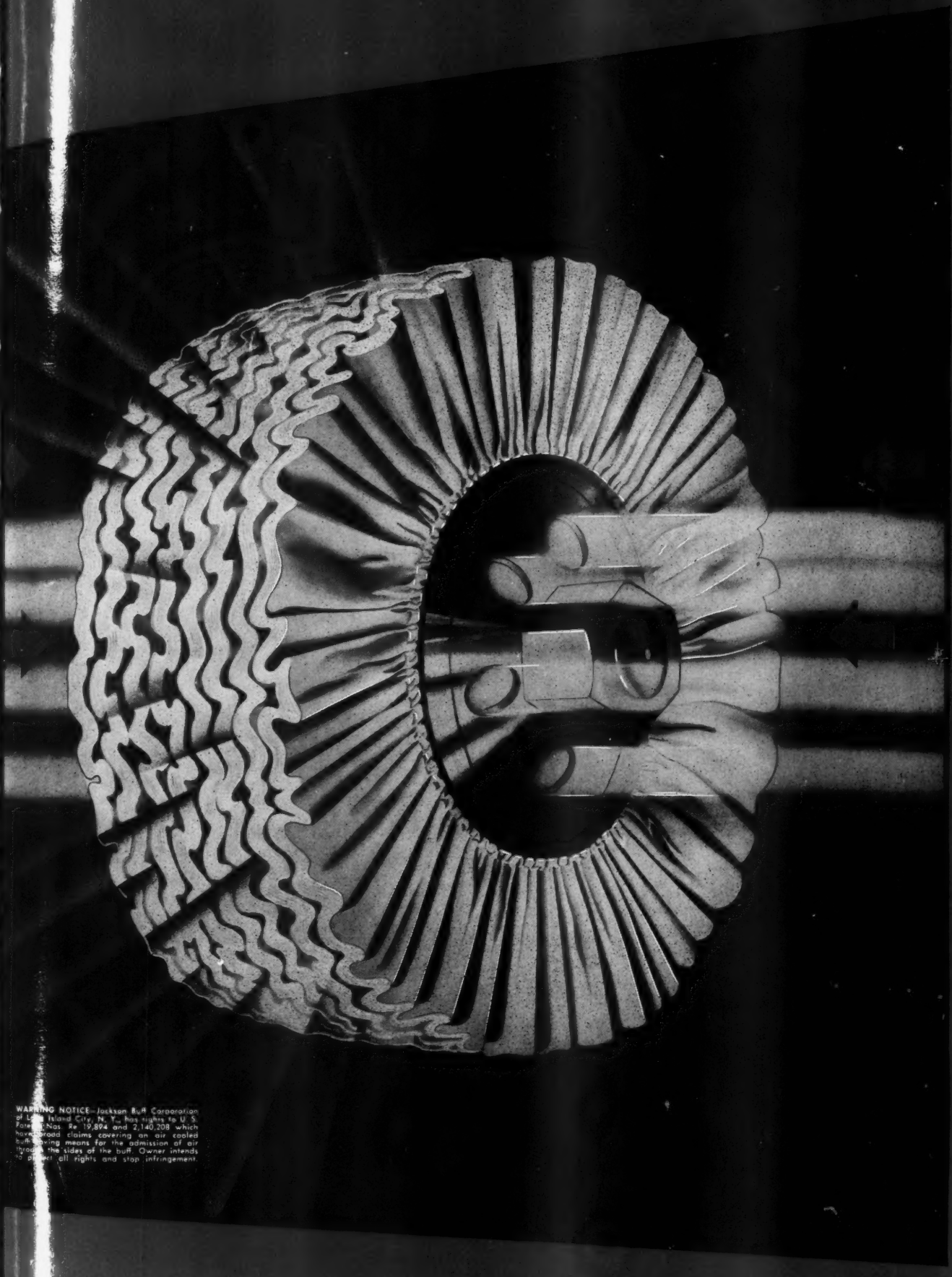

WARNING NOTICE—Jackson Buff Corporation of Long Island City, N. Y., has rights to U. S. Patent Nos. Re 19,894 and 2,140,208 which have broad claims covering an air cooled buff having means for the admission of air through the sides of the buff. Owner intends to protect all rights and stop infringement.

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"The Fundamentals of Electrochemistry and Electrodeposition" by Samuel Glasstone. Price $2.50.

Twenty authoritative chapters in simple language on the properties of solutions, Faraday's Laws, pH, electrode potentials, overvoltage, polarization, anode behavior, corrosion, etc. Successfully used for classroom instruction.

Proceedings of the American Electroplaters Society Vol. 33, 1946. Price $6.50.

Twenty-one papers on copper, nickel, rhodium and tin plating; plating of strip and wire screen cloth; electrocleaning and electropolishing; magnesium treatment and parkerizing; polishing and buffing; organic coatings, etc. A. E. S. Research Annual Reports.

Proceedings of the American Electroplaters Society Vol. 34, 1947. Price $10.00.

Fourteen papers and eight A. E. S. Research Annual Reports on barrel plating of nickel and chromium; brass, cobalt and nickel plating; zinc treatments; electroforming; buffing; physical properties of and stress in electrodeposits; plating room waste disposal; health hazards.

"Adhesion of Electrodeposits" by A. L. Ferguson. A. E. S. Research Reports Ser. Nos. 1 & 2. Price 60c and 40c respectively.

Detailed bibliography, general considerations, correlated abstracts of published and unpublished methods for measurement of adhesion.

"Determination of Impurities in Electroplating Solutions" by Earl J. Serfass and W. S. Levine. A. E. S. Research Report Ser. No. 3. Price 50c.

First in a series. Colorimetric techniques and methods for determination of lead, iron, manganese and copper in nickel plating solutions.

"Stripping of Copper from Various Base Metals" by F. C. Mathers, C. E. Landwerlen and E. C. Martin. A. E. S. Research Report Ser. No. 4. Price 35c.

Literature review and bibliography of a variety of methods.

"Porosity of Electrodeposited Metals" by N. Thon and E. T. Addison, Jr. A. E. S. Research Report Ser. No. 5. Price 80c.

Critical literature review and bibliography of chemical and physical methods with alphabetical index of test methods by metals.

"Specifications and Tests for Electrodeposited Metallic Coatings" sponsored by American Society for Testing Materials and American Electroplaters' Society. Price $1.25.

Specifications for zinc, cadmium, lead, and copper-nickel-chromium coatings on steel, copper-nickel-chromium coatings on brass and zinc base die castings, and chromate finishes on steel; methods for tests; and recommended practical for hard chromium plating and for preparing low-carbon steel for plating.

Send your order, with check, to

AMERICAN ELECTROPLATERS' SOCIETY

P. O. Box 168, Jenkintown, Pa.

Personals

Martin W. Radom has been appointed Detroit area District Manager with offices at 2970 West Grand Boulevard, Detroit 2, Mich., by the American Buff Company, 2414 S. La Salle Street, Chicago, Ill.

Radom

Mr. Radom, a graduate of the University of Michigan, served overseas as an army captain in World War II. He has been in service-engineering capacity with the American Buff Company since his separation from military service.

William D. Wilson has been appointed District Sales Representative in Northern New Jersey and New York City for the Special Chemicals Division of the Pennsylvania Salt Manufacturing Company. Before joining Pennsalt last January, he was a chemist with the McCormick Rubber Company, Ridgefield Park, N. J., for eleven years and with Curtis-Wright, Caldwell, N. J., for six years. Mr. Wilson, a graduate of Pratt Institute, Brooklyn, N. Y., is a member of the American Electroplaters' Society. He and Mrs. Wilson and their two children reside at 31 Byrd Avenue, Bloomfield, N. J.

John A. Bauer, former Sales Manager of the Hanson Van Winkle Munning Company, has been appointed Vice-President and Sales Manager to succeed Louis M. Hague, newly appointed President of the Company. Mr. Bauer has been with the company twenty-two years, starting as Advertising Manager of the former A. P. Munning Company. He later served as Manager of the Pittsburgh, Philadelphia and New York offices, returning to the home office in 1939 as Assistant Sales Manager.

Bauer

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PATENTED
POLISHING WHEEL CEMENT

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GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

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To make *your* products stand out competitively, specify HARRISON cake or liquid compounds. Their fast cutting and quick cleaning action insure economy of operation.

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SPARKLER
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Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
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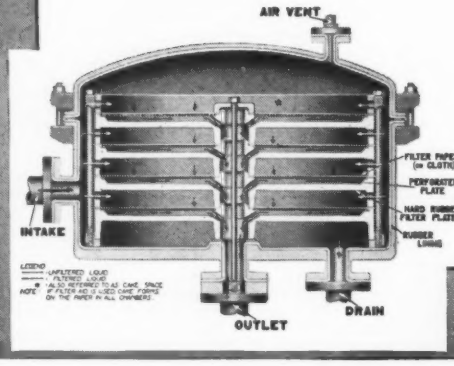

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Our Engineering Service is available for any specialized problems.

Personals

Robert M. Norton has been appointed Assistant Sales Manager by the Hanson-Van Winkle-Munning Company, Matawan, N. J. Prior to his new assignment Mr. Norton was engaged in sales promotion activities at Matawan; before that he served Hanson-Van Winkle-Munning customers in the electroplating and polishing equipment and supply field in the capacity of District Manager for New York and New England, and Field Representative in the New York State territory. Before joining the organization in 1940, he was a District Sales Manager for the Western Union Telegraph Company.

Norton

Russell C. Fancher has been appointed Sales Representative of The U. S. Stoneware Company in the Detroit area. He will work out of its newly opened office at 6432 Cass Avenue.

Mr. Fancher is well known to the chemical and metal finishing trades in the Detroit area and is a member of The American Electroplaters' Society, American Society for Metals, American Chemical Society, and Detroit Junior Chamber of Commerce. He is a graduate of Detroit Institute of Technology with a B.S. degree in Chemistry, has taken additional work at Penn State College and at Loughborough Technical College, England, and is a Key member of The Sigma Rho Tau, honorary engineering fraternity. Prior to his 1943 enlistment in the U. S. Army, Mr. Fancher worked for several manufacturing organizations in Detroit, in both the chemical and metal-finishing fields. Receiving his discharge from the Combat Engineers in 1946, he joined the sales organization of Eaton Chemical and Dyestuff Company of Detroit, where he specialized in sales and service of metal-finishing processes and chemicals, particularly bright nickel and color anodizing.

Marvin J. Udy, internationally known chemist and metallurgist, was awarded the Jacob F. Schoellkopf Metal for 1948 by the Western New York Section of the American Chemical Society. Among Udy's better known achievements is the

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Cadmium Anodes
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FOR CHROMIUM PLATING
Lead Alloy Anodes
Chromic Acid

FOR COPPER PLATING
Copper Anodes
Bright Copper

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Nickel Anodes
Bright Nickel
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Nickel Chloride
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FOR SILVER PLATING
Silver Anodes
Silver Cyanide

FOR TIN PLATING
Tin Anodes
Sodium Stannate
Sodium Acetate

FOR ZINC PLATING
Zinc Anodes
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JUST NAME WHAT YOU NEED! HERE'S . . .

Everything from Anodes to Zinc salts

IN PLATING AND POLISHING SUPPLIES

Here—under one roof—is everything you need for modern, high-efficiency plating and polishing operations. *And that spells real convenience for you!* It saves your time, it simplifies your records, and means speedier service when you make a habit of ordering all your plating supplies from Udylite Corporation. All Udylite supplies are laboratory-tested to assure maximum serviceability and efficiency . . . *with satisfaction guaranteed.*

COMPLETE TECHNICAL SERVICE AT YOUR COMMAND

Udylite's Technical Staff and modern electroplating laboratories are at your service at all times to help you develop better, more profitable operations. We will test your solutions, without cost . . . design entire plating plants . . . advise on operating methods and processes. Call us in on *any* plating problem — no obligation whatever.

PIONEER OF A BETTER WAY IN PLATING . . .

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Personals

development of the process for cadmium plating, the patents for which were the basis for the formation of The Udylite Corporation of Detroit, and the chromium plating process successfully cited against Fink's patents in several patent suits.

James A. Lee, Managing Editor of "Chemical Engineering" magazine, at the Annual Business Meeting of The Electrochemical Society during its 93rd Convention, was elected the Society's President, to succeed Mr. George W. Heise. Accession to the presidency culminates Mr. Lee's long service on the Board of Direcotrs. **Ralph M. Hunter,** Manager of the Electrochemical Division of the Dow Chemical Company, was elected Vice-President. **Dr. R. M. Burns,** Chemical Director of Bell Telephone Laboratories, Inc., was re-elected Secretary, and **W. W. Winship,** formerly with the Thermal Syndicate, Ltd., and beginning with June 1 with Winship Silica Products Company, First National Bank Building, Freeport, L. I., N. Y., was re-elected Treasurer.

Ernest James Wright has been appointed Development Engineer of the Australian General Electric Company, Auburn, Sydney. Mr. Wright, who is the president of the Sydney, Australia, Branch of the American Electroplaters' Society, was formerly the Senior Foreman of the Metal Finishing, Appliance Assembly, Bakelite Mouldings and Coil Winding Departments of the same company. **Mr. John R. Godfrey,** who is the secretary of the same branch, has been left to supervise the metal finishing department as Junior Foreman. Both Mr. Wright and Mr. Godfrey have completed twenty years of service with the company.

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Niehaus Fume Separator

● Niehaus Fume Separators will reduce your overhead two ways . . . overhead expenses and space-consuming overhead ductwork. By water absorption and centrifugal separation, it will effectively control the fumes from your cleaning and plating solutions.

The complete unit is located alongside your tank . . . no expensive blowers or long ducts are required. No air is discharged outside.

For complete specifications and information on how the Niehaus Fume Separator eliminates costly equipment, reduces installation costs, and sells for less. Write for illustrated folder.

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219 West Vermont Street, Indianapolis 4, Indiana

WANTED: Aggressive man, 26 to 32 years of age, with chemistry or chemical engineering background and some industrial experience in electro-plating and metal finishing field. Position in general sales department work, plant layout, compiling proposals, quotations, etc. Some service and outside sales work as ability is developed, pointing, after sufficient training and experience, to sales engineering position. Midwest manufacturer, operating nationally. Write fully giving education and experience details, including salary expected. *Reply to:*

P-7A, PLATING
P. O. Box 168, Jenkintown, Pa.

POSITION OPEN

Plating Room Foreman: Capable man between 30 and 40 years old with 8 to 12 years plating experience, especially in plating zinc base die castings and able to control copper and brass plating solutions by chemical analysis, to have full responsibility in small plating department with 10 employees. Southern Atlantic State. Beginning salary, $3,600.00. *Reply to:*

P-7B, PLATING
P. O. Box 168, Jenkintown, Pa.

SALESMAN WANTED

Nationally known manufacturer has opening for a man with a thorough knowledge of polishing and buffing equipment, wheels, compositions, etc. Previous sales experience desirable. Must be free to travel. State age, experience, and salary expected. *Reply to:*

P-7C, PLATING
P. O. Box 168, Jenkintown, Pa.

ELECTROPLATING ENGINEER DESIRES POSITION

Mature man with diversified experience in copper, nickel, chromium and silver plating, including rack design, equipment maintenance, analysis, and research, who has specialized in beverage-making devices and also in thermostat design and use and who has had more than four years of college training in electrical engineering and chemistry, seeks responsible position. *Reply to:*

P-7D, PLATING
P. O. Box 168, Jenkintown, Pa.

Editorial

July 1948

NICKEL SHORTAGE

SINCE THE WAR electroplating has become the second largest single outlet for nickel. This is at least partially explained by the increased nickel coating thicknesses which are being applied for purpose of improved rust protection.

Like the demand for nickel anodes, the total demand for nickel has increased to a point that it exceeds the production by a substantial margin. It has therefore been necessary, beginning May 1, to limit shipments to consumers on the basis of their last year's consumption, a policy which certainly will continue through the month of July and probably into the Fall.

What then is the plater going to do to meet the current high demand? Two methods were used in 1941 when a similar situation existed. One was to substitute copper for a portion of the nickel, keeping the total thickness constant or increasing it slightly. That that was a poor idea soon became evident from the appearance of the bright work on the cars in the street and, according to the Editors' observations, fully substantiated by the behavior of the copper-nickel-chromium plated panels now being exposed outdoors by Committee B-8 of A. S. T. M.: copper adds very little if anything to the protection afforded by the nickel, and, in industrial atmospheres, tends to cause increased staining of the plate. Another was to zinc plate, buff the zinc, and protect it with a clear, adherent lacquer enamel. That method provided rust protection, at least where the organic film was not cut through or abraded in service, but the appearance certainly was inferior to that of chromium plate.

What, then, is the answer? Eliminate waste wherever possible, reduce the nickel thickness as much as necessary, and, possibly, apply a non-permeable, adherent, clear synthetic coating over the chromium wherever feasible—these seem to be the logical steps according to our present knowledge. Our readers would benefit from additional information and suggestions pertaining to this important subject.

Gustaf Soderberg

BETTER DEPOSITS AT GREATER SPEEDS BY

P R PLATING

GEORGE W. JERNSTEDT

Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania

PERIODIC REVERSE Current Electroplating* has been developed to a point that today it is feasible to deposit superior copper coatings commercially at higher rates than have ever been possible under comparable conditions. P R current apparatus for some capacities is already available with reasonable deliveries and costs. Beneficial results have been secured in pilot-line production with brass, silver, zinc, tin, cadmium, gold, iron and nickel. As equipment becomes available and experience is gained, the P. R. process should find widespread application also with these metals.

* Patents pending to the Westinghouse Electric Corporation, Pittsburgh, Pa.

GEORGE W. JERNSTEDT has been with Westinghouse since he took chemical engineering in Newark College of Engineering (B.S. 1937) and since 1946 as its Manager of Electroplating Projects. His further schooling includes graduate work at Polytechnic Institute of Brooklyn and at Michigan State College (M.S. 1940).

Mr. Jernstedt holds many patents on electroplating developments including beryllia plating, a pre-dip for phosphating known as Fixodine Z, a bright-alloy plating method called Albaloy Plating, and Periodic Reverse Current Electroplating.

P R electroplating is practiced by reversing the plating current briefly at short, periodic intervals. In this manner, unsound and inferior metal deposited in the previous plating interval is removed, and succeeding layers are always plated on sound metal to produce a deposit of superior qualities of strength, elasticity, density, and freedom from flaws such as porosity.

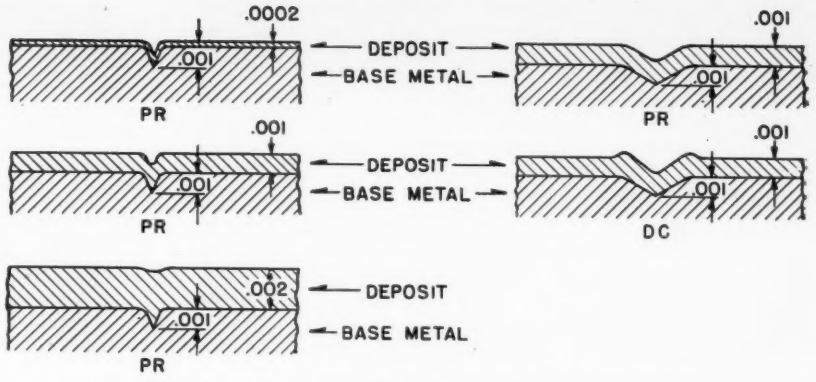

Fig. 1. Schematic illustration of throw in P R plating. Left: progressive filling of deep, narrow scratches; right: absence of filling of grooves or engraving cuts which instead are faithfully reproduced by P R plating (top) in contrast to D C plating (bottom)

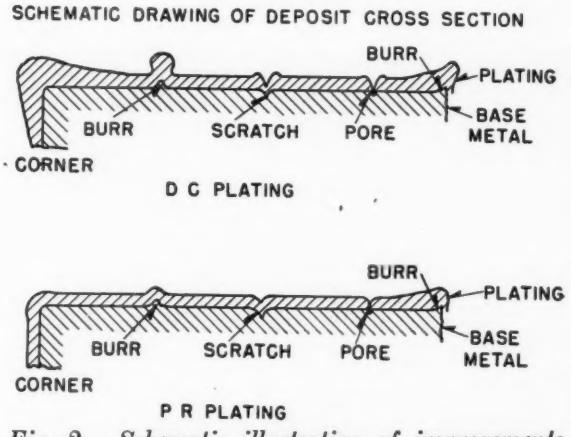

Fig. 2. Schematic illustration of improvements possible with P R plating (top) over D C plating (bottom). From a variety of actual specimen cross sections

Uniformity of Coating

Throwing power with P R plating is increased greatly as evidenced by the uniform distribution of metal on the edges and in the center of a panel. Furthermore, scratches, pores, and nodes in the base metal that are generally emphasized by conventional plating methods tend to be smoothed over in the P R plating process. In Fig. 1, left, a narrow scratch, 0.001 inch deep, is shown as it is progressively being filled with P R plated copper. In Fig. 1, right, a wide scratch is shown plated with D C and with P R It is evident that wide scratches or cuts are not filled but faithfully reproduced. Practical examples of this condition have been seen where 0.016 inch thick copper has been P R plated over engraved initials without any of the detail being lost.

In Fig. 2 the effects of typical imperfections in the base metal are compared for both conventional and P R methods. Burrs become reduced in prominence, and scratches tend to become filled. Evidently the deposit forming over the high points of the burrs is particularly susceptible to improvement by the use of reversed current and irregularities tend to be smoothed out. The contrast between the buildup by the two methods at the corners of the base metal may seem exaggerated in Fig. 2, but the photomicrograph in Fig. 3 is an indication of how uniformly a P R deposit does follow around corners. The lines parallel to the base are exaggerated to show this more clearly. There is extremely little buildup on the corners and little evidence of nodules with this approximately 0.040 inch thick cyanide copper deposit. A cycle more sacrificial than normal which gave a current efficiency of 50 per cent was chosen in this case to indicate the possibilities of the new method. However, this efficiency is comparable to that of conventional electroforming practice in acid copper solutions and the tough, dense, well-distributed cyanide-plated copper offers many advantages.

Absence of Nodules

In the past, it never has been possible to build up heavy deposits of copper plate in a cyanide bath. On a relatively rough base metal, with rapid filtration and agitation in a high-speed bath, 0.016 inch thick copper plate has many nodules, as can be seen in Fig. 4. Even when the base metal has been polished and the solution is being agitated and filtered and contains organic brighteners, the deposit still develops nodules like those of Fig. 5 after a few thousandths of an inch have been applied. As compared with this, a 15-second cathode, 5-second anode contactor cycle in P R plating produces the smooth, heavy deposits of Fig. 3. Agitation and filtration are still recommended, but it is possible to eliminate the use of organic addition agents when P R plating is used.

Plating Speed

Because of the reversed current periods in the P R plating cycle, the reasons why the overall plating time is decreased may not be obvious. Actually, much higher speeds and current densities are possible with the new process because of the additional metal ions that are formed at the face of the cathode during the period of current reversal.

Smoothness of Deposits

Even at these higher speeds, the quality of the deposit is generally better than that with the best direct-

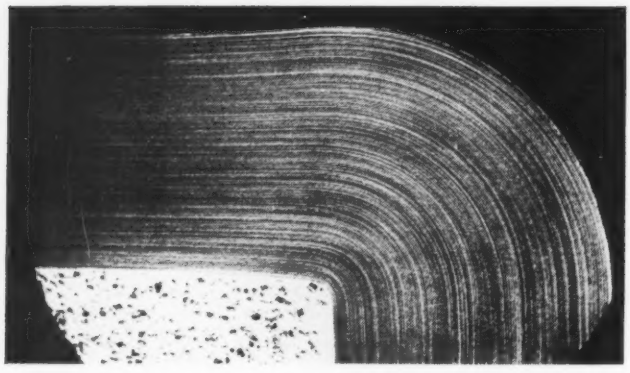

Fig. 3. Photomicrograph of 0.040 inch thick copper coating deposited by P R plating in a high speed potassium copper cyanide bath without addition agents at 180° F and 50 per cent efficiency (15-second cathode, 5-second anode cycle) without agitation. 50 X, reduced to 25 X. Absence of build-up on corners important in electroforming

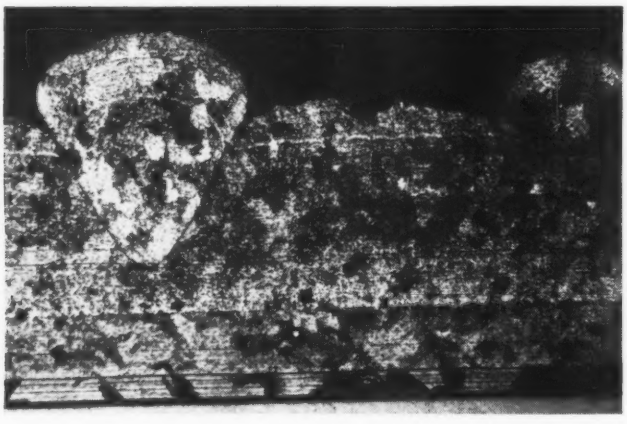

Fig. 5. Photomicrograph of 0.020 inch thick copper coating with nodules deposited by D. C. plating on very smooth base metal in high-speed potassium copper cyanide bath containing organic addition agents operated with filtration and agitation at 180° F. 200X, reduced to 100X.

current plating. For instance, from seven to ten hours had been required to deposit 0.016 inch of copper by potassium-copper cyanide barrel plating. By rack plating five hours were required, but the coating was very rough in appearance. P R plating required less than four hours to produce a plate of the same thickness and superior to those of either of the conventional methods.

A direct comparison of plating results at various current densities is given in Fig. 6. Here standard samples were plated in a simple copper sulphate-sulphuric acid bath. The panels shown to the right were processed by the P R method with a two-second cathode, one-half-second anode cycle; those to the left were plated with continuous direct current. Roughness in the panels plated with continuous direct current becomes increasingly evident at current densities above 50 asf.

The two panels in Fig. 6 plated at 50 asf were put

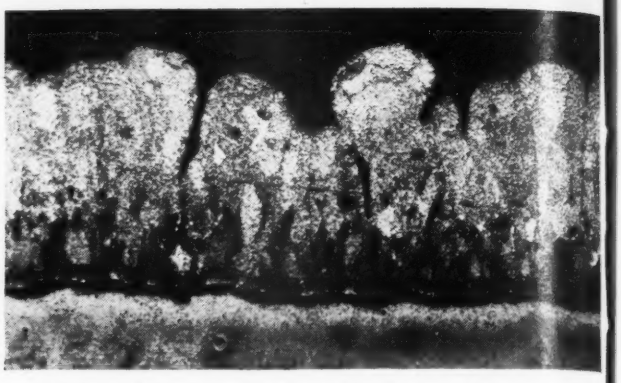

Fig. 4. Photomicrograph of 0.016 inch thick copper coating with typical nodules deposited by D C plating on rough base metal in high-speed potassium copper cyanide bath containing organic addition agent operated with filtration and agitation at 180° F. 200X, reduced to 100X.

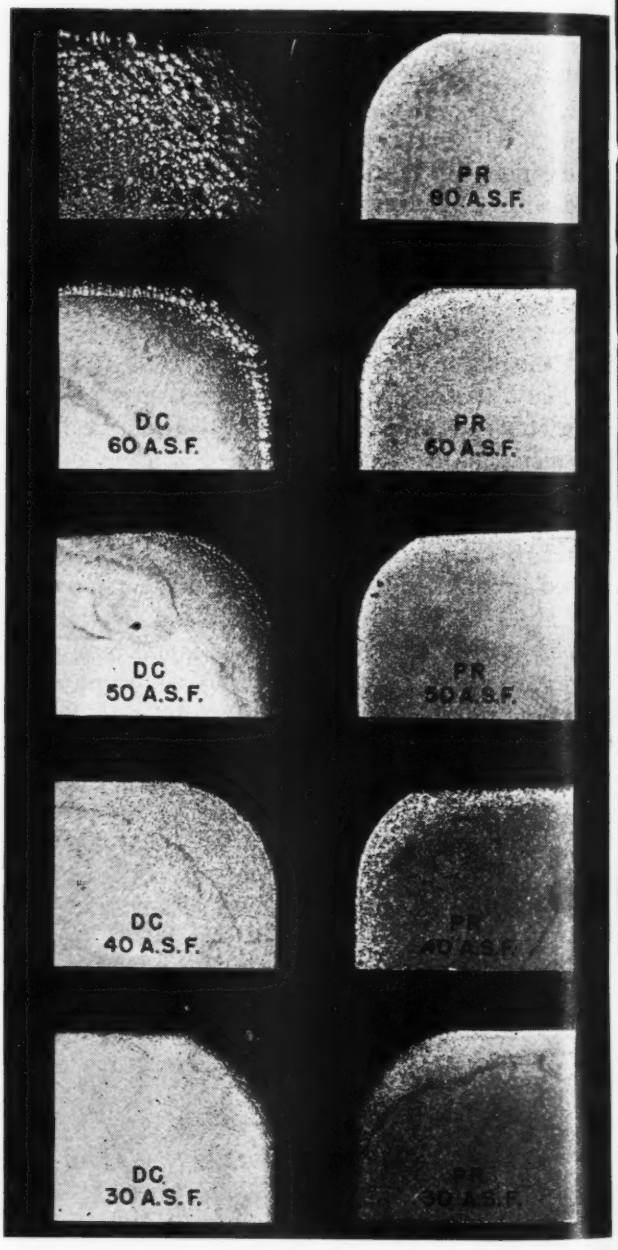

Fig. 6. Corner effects in D C and P R plating with simple copper sulfate-sulfuric acid bath without addition agents or agitation at room temperature. P R cycles: 2-sec. cathode, ½-sec. anode

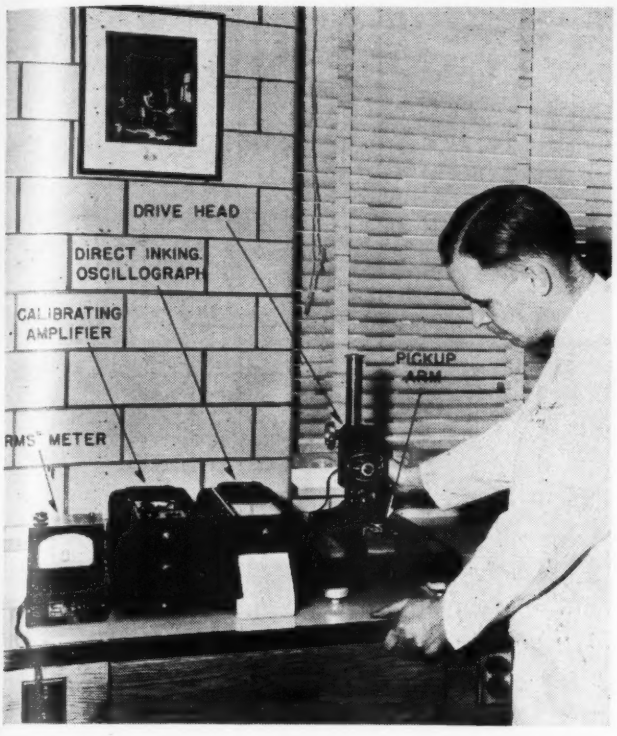

Fig. 7. Brush analyzer employed for measurements of surface roughness

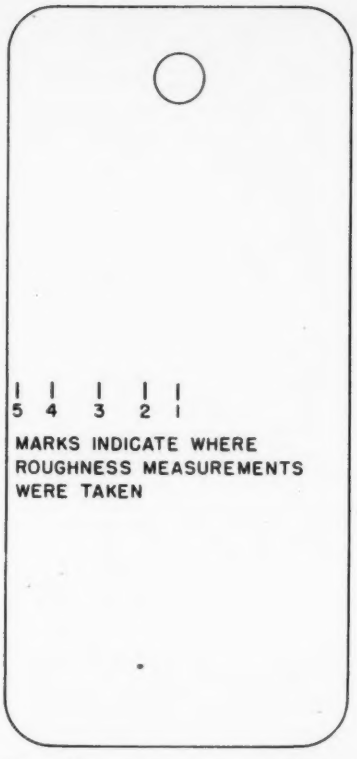

Fig. 8. Locations of surface roughness measurements on standard panels

in the Brush Surface Analyzer shown in Fig. 7, and surface-roughness measurements were taken at the locations shown in Fig. 8. Results of these measurements as given by the root-mean-square meter are shown in Fig. 9 and indicate how the roughness of the deposit near the edges does not become excessive with P R plating.

The lines on the charts of Fig. 9 had to be inked by hand for better reproduction so they are only approximate. To indicate better the actual roughness values, they have been plotted as root-mean-square values of roughness in microinches in Fig. 10 against distances from the edge of the panel. Roughness of the P R plate varies from approximately four microinches at a point near the edge to around one microinch at the exact center of the panel. This ratio of about 4:1 can be compared with an approximate ratio of 8:1 in the continuous-current plate. At the center of the panel, conventional plating methods produce a roughness value of slightly over five times that found with P R.

P R plating is more advantageous with higher current densities than is continuous direct current (see Appendix). While the amount of metal plated per ampere-hour is somewhat less than with direct current, in most plating installations the cost of current is a minor item when compared to the cost of labor, equipment, and solution maintenance. Savings resulting in reduced buffing and polishing costs because of the smoother, brighter finish from P R methods and the greater output possible from a given installation far overshadow any increase in the cost of power.

Reversal Equipment

It is essential that switching be rapid for best results when the new process is used. If the current does not build up to the full amount immediately after reversals in the P R cycle, the process becomes less efficient (see Switching Efficiency in Appendix) and maximum lustre does not develop. With poor current reversal, plating speeds may be reduced and inferior deposits may result.

The current can be reversed for P R plating either by reversing the field excitation of the D C plating generator or by means of a contactor. Both methods have been tried in the laboratory and in commercial practice. While reversing the generator field can be accomplished with a minimum of equipment, experience indicates that this is not the most satisfactory way. Reversal of the low-voltage plating current by contactors has advantages that more than offset the additional cost of this equipment.

A current-switching curve of a low-voltage contactor is given in Fig. 11; it will be noticed that when the contactor closes, the current builds up almost instantaneously to its full value in either direction. A comparable curve of current from a generator when the field is reversed is shown in Fig. 12; two or three seconds are required after each reversal before the full current becomes fully effective. The shaded areas are a measure of the coulombs not available because of these delays. As a consequence the plating time must be lengthened for the same result by as much as 10 per cent.

Heavy-duty contactors are available for currents

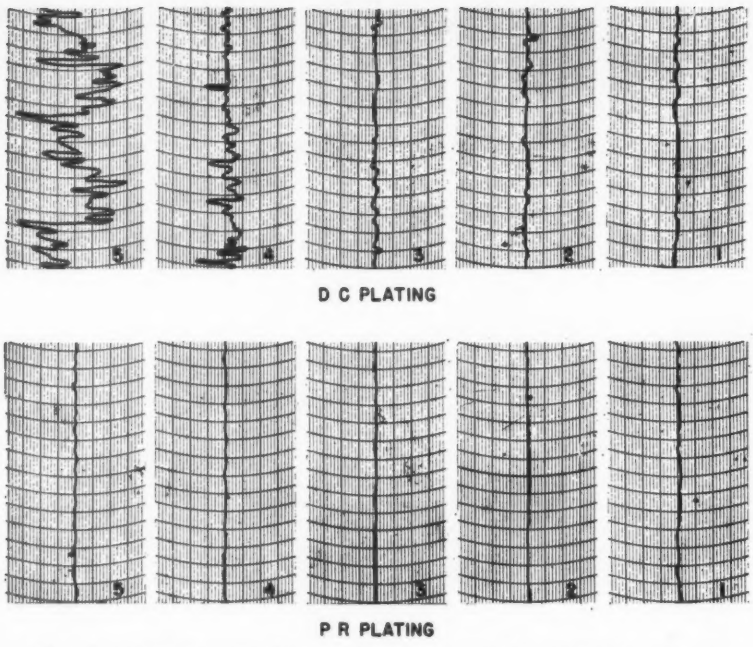

Fig. 9. Surface roughness charts of panels plated by D C and P R at 50 asf. Figures refer to locations in Fig. 8

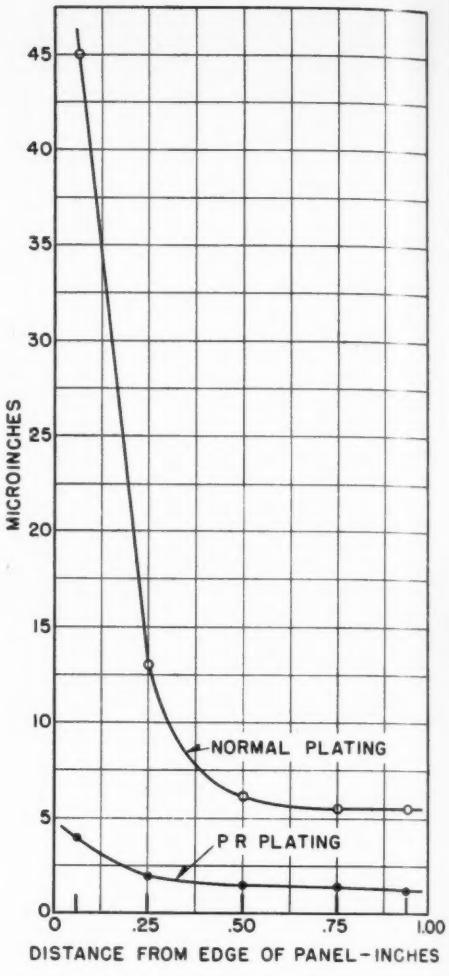

Fig. 10. Surface roughness from Fig. 9 plotted against location

up to 1000 amperes, and active development work is being carried out on larger units. The requirements are long life, which means many millions of operations, and uniform cycling. An actual oscillograph of a 1200-ampere contactor in operation is shown in Fig. 13. Cycling is obtained by means of an electronic timer, such as shown in Fig. 14, which is not affected by the usual fluctuations in line voltage and gives the required accuracy of cycling. The current carrying capacity is 100 amperes, so that the unit not only can be employed to operate contactors for heavy currents but also can itself be used for reversing currents within its range.

Anode Behavior

While improvements to the cathode have been discussed in this article*, nothing has been said about the anodes. In cyanide copper plating with direct current quite frequently difficulty is encountered with the anodes becoming passive or black. Generally, this results from too low a free cyanide or hydroxide content or too high a current density. With P R plating this trouble is greatly reduced and usually eliminated. In addition, the anodes corrode more uniformly. They do not dissolve away at the edge but are reduced uniformly in thickness, thereby maintaining a more nearly constant anode area. This condition should prove a real advantage in large conveyor lines.

APPENDIX

Definitions

Cathode Current Efficiency: The percentage of coulombs which is effective in depositing metal on the work while it is cathode (conventional D C cathode efficiency).

P R Cycle Efficiency: The net time of plating divided by the total cycle time (assuming 100 per cent switching efficiency, i. e., instantaneous switching.

Switching Efficiency: The time of plating plus the time of deplating divided by the total time of a cycle, assuming a square wave to plate and deplate amounts equal to those in the actual P R cycle. This is a measure of the time lost due to failure to accomplish full reversal of current flow instantaneously and depends on a combination of mechanical and electrical factors.

Anode Current Efficiency: Since the work is alternately anode and cathode, the identical area is involved and the anode and cathode current densities are the same. In most cases the anode and cathode current efficiencies will be approximately the same and, for the sake of simplicity, are assumed to be equal.

Effective Current Density: The current density that by direct current methods would cause deposition of the same amount of metal in the same time as obtained with a given P R process.

*Also in article, "Periodic Reverse Current Electroplating", by George W. Jernstedt, *Metal Finishing*, February, 1947, p. 68.

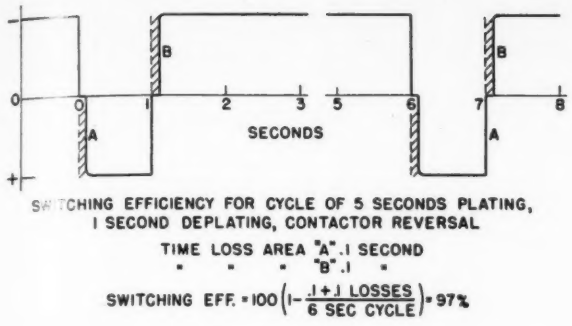

Fig. 11. Schematic illustration of current variation during low-voltage P R plating with contactors in plating circuit

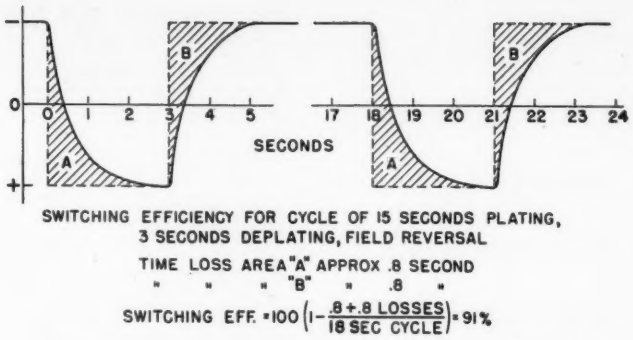

Fig. 12. Schematic illustration of current variation during P R plating with generator field reversal

Calculations

The theoretical P R cycle efficiency (assuming 100 per cent switching efficiency) can be obtained by the following expression:

$$(1)\quad \frac{\text{Plating Time} - \text{Deplating Time}}{\text{Plating Time} + \text{Deplating Time}} \times 100 = \text{P. R. cycle efficiency in \%}$$

For the cycle in Fig. 11, this would be:

$$\frac{5-1}{5+1} \times 100 = 66\tfrac{2}{3}\%$$

The overall efficiency of a P R plating operation is still lower because of the time required to change the direction of the current, i. e., the switching effiicency factor. An indication of the magnitude of this efficiency may be seen in Figs. 11 and 12.

Taking the example just given for a 5-second cathode, 1-second anode cycle and assuming a 95 per cent cathode current efficiency and the 97 per cent switching efficiency shown in Fig. 11, the overall efficiency for the P R installation would be as follows:

$$66\tfrac{2}{3}\% \times 95\% \times 97\% = 61\%$$

Most applications for P R plating will fall in the range of 60 to 70 per cent overall efficiency.

Another method of evalvating the rate of plating for a P R cycle is to determine the cathode current density during the plating period and employ it in the following expression:

(2) Cathode current density x P R cycle efficiency* = effective current density

In P R plating, the effective current density obtained in this manner is the current density required to deposit an equivalent amount of metal in the same time with direct current.

The effective current density multiplied by the switching efficiency can be employed in the standard direct-current procedures to determine plating rates and efficiencies.

*See equation (1).

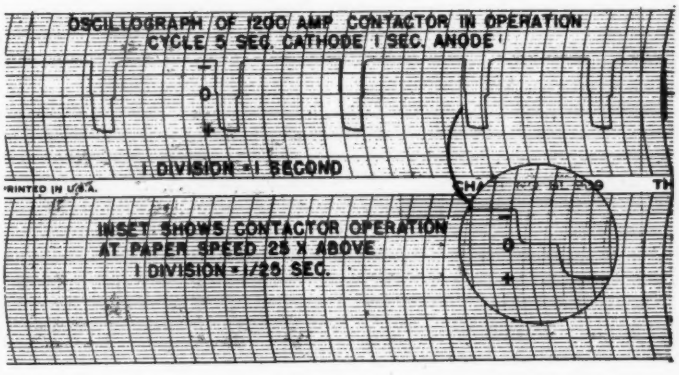
OSCILLOGRAPH OF 1200 AMP CONTACTOR IN OPERATION
CYCLE 5 SEC. CATHODE 1 SEC. ANODE
0
1 DIVISION = 1 SECOND
INSET SHOWS CONTACTOR OPERATION
AT PAPER SPEED 25 X ABOVE
1 DIVISION = 1/25 SEC.

Fig. 13. Actual oscillogram of current variation during low-voltage P R plating with contactors in plating circuit

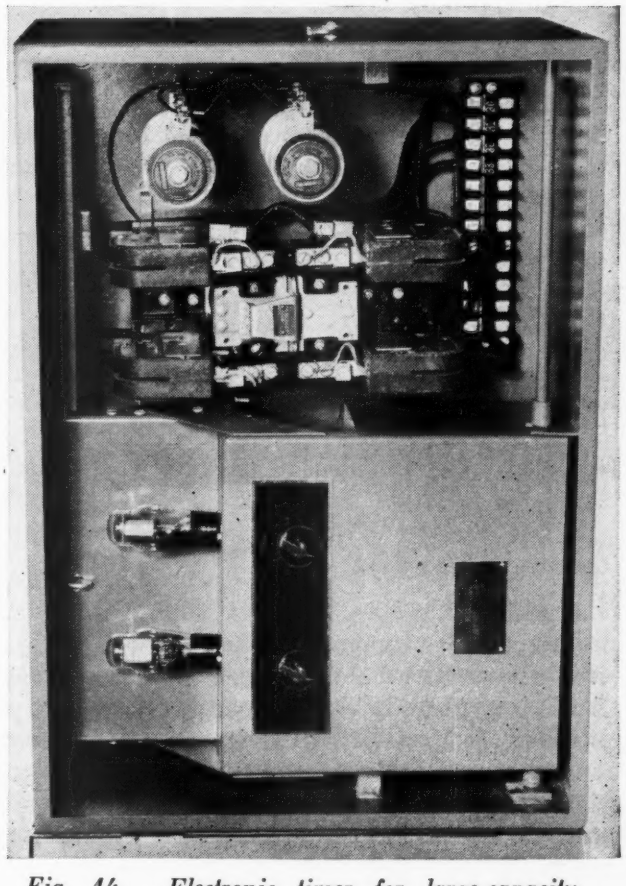

Fig. 14. Electronic timer for large-capacity contactor

William Blum

WILLIAM BLUM can look back on a very fruitful life in the service of the electroplating industry. As Chief of the Electrodeposition Section of the National Bureau of Standards he has contributed much to our knowledge of plating fundamentals.

Born in Philadelphia on December 28, 1881, as one of nine children, Blum early learned the art of getting along with others, an ability which has earned him a very large host of friends. He graduated from University of Pennsylvania in 1903 and went to teach at the University of Utah. He obtained his Ph.D. degree from his Alma Mater in 1908 and accepted an appointment at the National Bureau of Standards in 1908. During World War I his attention was directed to electroplating, which has since become his life's work.

It is difficult to select a few of Blum's contributions for special mention in this limited space; over seventy papers bear his name as author or co-author. Hardly any phase of electrodeposition has eluded his attention, be it scientific or technical. His monument is "Principles of Electroplating and Electroforming", which he first published in 1924 in collaboration with George B. Hogaboom. A second edition appeared in 1930 and rumor has it that a third is in preparation. The value of "Blum and Hogaboom" is best indicated by the fact that it is still a standard text for all who study electroplating, in spite of the fact that many of the described processes have undergone further development and refinement. Th principles so well thought through and presented still remain fundamentally unchanged.

Perhaps most important has been the teaching enjoyed by his younger associates at the Bureau, many of whom have themselves become important figures in the industry. All who have had the opportunity to work with him in technical and scientific societies and committeess have received from him inspiration and knowledge.

Among recognitions which properly have come to Blum are the presidency of the Electrochemical Society (1926) and its Acheson Medal (1944), the Medal of the American Institute of Chemists (1926), an honorary membership in the American Electroplaters' Society and its special award (1928).

But Blum's interests cover a much wider field than his science. He once served as mayor of his community, Chevy Chase, Maryland, and as such succeeded in having installed various public services opposed by the machine politicians. He has also been an active member of his church, Chevy Chase Presbyterian Church, and taken particular interest in its youth work.

Corrosion of cadmium plated parts in electromagnetic assemblies was found to be caused principally by the enclosure of certain phenolic base insulating materials and paints in intimate contact with the plated equipment. Since many of the corroding materials are essential to the operation of the equipment, it seemed desirable to alter the plating. From the tests reported here, cadmium-nickel-chromium plate finish is rated first for resistance to the formation of white salts and moisture corrosion, with cadmium-nickel and cadmium-tin rated approximately equal as second.

Notes on the prevention of white powder corrosion of cadmium plate

L. H. SEABRIGHT* AND J. TREZEK†

Kellogg Switchboard and Supply Co., Chicago, Illinois

Introduction

The object of this investigation was to determine the cause of the "white powder" corrosion of cadmium plated iron parts of electromagnetic assemblies and to find a means of eliminating it.

The corrosion product in question takes the form of white snowlike crystals, which frequently start to grow from exposed corners or edges. The crystals appear opaque in transmitted light but reflect light when illuminated from the direction of the observer. They often form such thick coatings on the surfaces that they cause moving parts to jam and mechanically prevent operation of the unit.

In reviewing the literature which deals with corrosion of cadmium plating, it was noted that Soderberg[1] had observed the same phenomenon with materials containing unsaturated oils. Cobb[2] describes another, somewhat similar phenomenon, the appearance of cadmium "whiskers" composed of straight needlelike crystals varying from 0.00001 to 0.00005 inch in diameter. It was considered that poor cadmium plating was the greatest factor in promoting the growth of whiskers.

Nature of Corrosion

Analyses of the "white corrosion" products have shown them to consist of water soluble organic material. In several instances cadmium formate was identified.

In all cases the cadmium plated parts were enclosed with certain organic materials such as impregnated fabric or paper used for electrical insulation, liquid seals, or paints containing oils of vegetable origin.

These materials decompose in the presence of warm air and high humidity and form volatile organic acids. High temperatures increase the rate of oxidation and volatilization of the impregnating materials, and high humidity promotes solution and dissociation of the vapors. In the absence of air circulation the vapors become sufficiently concentrated to attack the cadmium plate on the equipment assembly. This is borne out by the fact that corrosion of cadmium plated equipment is especially prevalent in tropical climates.

Experimental

A test similar to that recommended by Soderberg[1] was used to determine the tendency of materials to produce white salts. Each different kind of material was put in a separate glass stoppered bottle or container in contact with a plated part and heated at 225° F for up to 96 hours. The sample bottles were prepared in the humid atmosphere of the plating department in order to provide the desired atmospheric condition in the bottles. If no corrosion took place after 24 hours of heating, the material was considered safe for use. Where cadmium corrosion occurred on heating, the odor from the bottle resembled very closely the characteristic odor of burnt

*Methods Engineer †Plating Department Foreman.

TABLE I. DEPOSITS TESTED

Deposit	Thickness of Deposit
Cadmium	0.0003 inch Cd
Cadmium-tin	0.0002 inch Cd +0.0001 inch Sn
Cadmium-nickel	0.0002 inch Cd +0.0001 inch Ni
Cadmium-nickel-chromium	0.0002 inch Cd +0.0001 inch Ni +0.00001 inch Cr
Copper-nickel	0.0001 inch Cu +0.0002 inch Ni
Copper-nickel-chromium	0.0001 inch Cu +0.0002 inch Ni +0.00001 inch Cr

TABLE II. PLATING SOLUTIONS

Type	Composition		Current Density asf	Bath Temp. Degrees F	Anodes
	Chemical	oz/gal			
Cadmium	Cadmium*	3–4.5	25–45	70–90	Cast cadmium
	Sodium cyanide, total*	12–17.5			
	Caustic soda, total	2.1–3.2			
	Cadalyte† brightener	0.5–0.75			
Tin	Sodium stannate	12	20–30	150–180	Pure rolled tin
	Caustic soda	2–3			
	Sodium acetate	2			
Nickel‡	Nickel sulfate	16–18	10–20	75–85	Cast nickel
	Ammonium chloride	3			
	Boric acid	4			
Chromium	Chromic acid	40	100–150	120	6% antimonial lead
	Sulfuric acid	0.41			
Copper	Copper cyanide	2.1–2.5	10–15	75–100	Rolled copper
	Sodium cyanide, total	3.2–3.8			
	Sodium carbonate	1–4			

*Ratio NaCN/Cd = 3.9.
†Trade name registered by E. I. du Pont de Nemours & Company, Wilmington, Del. ‡pH = 5.4–5.7.

grease, the same odor which has been noted in the field. If the bottles were not well closed, the development of white powder took place very slowly or not at all. This verifies the field observation that white powder corrosion appears only when the access of air and proper circulation is prevented.

Some samples were rinsed in boiling distilled water after plating and others were rinsed in hot tap water, but no difference was found in the subsequent test results.

In order to determine the resistance of the finishes to moisture, finished specimens were suspended four feet above a boiling hot water tank in the plating plant until rusting occurred.

Because many of the materials which produce white salts are essential insulating materials which could not be eliminated from the equipment, tests were also run on composite coatings to find a more corrosion resistant finish. Copper-nickel, copper-nickel-chromium, cadmium-tin, cadmium-nickel, and cadmium-nickel-chromium combinations of the thicknesses shown in Table I were tried in addition to the standard cadmium finish. Some cadmium plated samples were coated with Maas & Waldstein No. 33 Water Dip Lacquer and tested as specified.

The specimens were magnetic iron, annealed after machining. They were cleaned with reverse current for one minute in a hot alkali cleaner containing 4–6 oz/gal (30–45 g/l) Pennsalt¶ K-7, rinsed twice in cold running water, pickled in concentrated muriatic acid until free from scale, immersed in two rinses of cold running water, dipped in the same alkali cleaner to neutralize the acid, and again rinsed in cold water.

The plating was carried out in the solutions and under the conditions set forth in Table II. The cadmium plated specimens were rinsed thoroughly in cold water, dipped for 15–30 seconds in a 5 per cent sulfuric acid solution, and rinsed in cold, in hot, and

(*Text Continued on page 718*)

¶Trade name registered by Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

TABLE III. HEATING TESTS

Test No.	Plate	Material	Time for Formation of White Deposit hours	Appearance of Plate
1	Cadmium	Varnished No. 103 Empire paper	16	Moderate white deposit
2	Cadmium	No. 103 Empire paper with activated charcoal	..	No deposit
3	Cadmium	Varnished cambric	24	Light brownish-white deposit
4	Cadmium	Phenolic insulators	24	Light brownish discoloration
5	Cadmium	Varnish impregnated coil	16	Heavy brown and white deposit
6	Cadmium	Electromagnetic coil (not impregnated) with heel iron	96	Very slight deposit
7	Cadmium	Aluminum painted test strips	24	Moderate brown and white deposit
8	Cadmium	No. 9440 Gray Enamel on test strips	24	Moderate white deposit
9	Cadmium	No. 100 Murphy's Black Enamel on test strips	72	Very slight white deposit
10	Cadmium	Cellulose acetate type coil with one phenolic spool head	48	Slight deposit near phenolic spool head
11	Cadmium	Cellulose acetate film	..	No deposit
12	Cadmium with water dip lacquer	Varnished No. 103 Empire paper	16	Moderate white deposit
13	Cadmium-tin	Varnished No. 103 Empire paper	48	Slight brown stain
14	Copper-nickel	Varnished No. 103 Empire paper	..	No deposit
15	Copper-nickel-chromium	Varnished No. 103 Empire paper	..	No deposit
16	Cadmium-nickel	Varnished No. 103 Empire paper	..	No deposit
17	Cadmium-nickel-chromium	Varnished No. 103 Empire paper	..	No deposit

TABLE IV. RUSTING OF SPECIMENS SUSPENDED OVER HOT RINSE TANK

Plate	Time for Corrosion weeks	Comments
Cadmium	5	No rust
Cadmium-tin	5	No rust
Cadmium-nickel	2	Slight rust and discoloration
Copper-nickel	5	Rust formed rapidly
Copper-nickel-chromium	5	Rust formed rapidly
Cadmium-nickel-chromium	5	Slight rusting

again in cold water, all in order to remove traces of the plating solution from the pores of the metal. After tin plating or nickel plating, the specimens were rinsed in two cold waters and in hot water; after copper plating in two cold waters; and after chromium plating in cold water and in hot water. Following the final plating and rinsing, the specimens were dried.

Both plating solutions and rinses had been highly purified to make certain that any corrosion products did not form because of improper methods.

The *p*H of the plating solutions was determined at the operating temperatures of the bath with a Leeds and Northrup glass electrode *p*H meter. The solution composition was maintained within plus or minus 10 per cent of the listed composition. Regular tests were also made with the Hull Cell to maintain a maximum bright plating range. Uniformity of current density throughout the tanks at the listed values was assured by checking at different points with a current density meter, Model 56 of the Reliance Instrument Company.

Plate thickness tests were made with the Magne-Gage using the method specified for composite coatings: the thickness of the initial cadmium or copper plate was determined first by means of the method for non-magnetic plate over iron; the total plate thickness was measured after completion of plating. The combined thickness of nickel and cadmium was measured as if it were 100 per cent nickel; from this "apparent" thickness and the actual cadmium plate thickness, the actual total thickness was determined using the graphs furnished with the instrument.

Results

The results of the heating tests on materials suspected to cause white powder corrosion of cadmium are shown in Table III. This table also shows the effect of a phenolic-base varnished paper (No. 103 Empire) on combination coatings of cadmium-tin, cadmium-nickel and cadmium-nickel-chromium as well as of copper-nickel and copper-nickel-chromium.

The rust resistance of the several coatings in a humid plating room atmosphere is indicated in Table IV.

Conclusions

In general, the tests have indicated that

1. White powder corrosion of cadmium plated parts takes place in closed spaces when phenolic-base paints, varnishes or insulating materials are present.
2. The active substances are fumes, for example of formic acid.
3. The corrosion may be prevented by absorption of the fumes with activated carbon (Test No. 2, Table III).
4. Thin water-dip lacquer coatings over the cadmium plate does not add resistance to this type of corrosion.
5. Top coatings of tin, nickel, or nickel-chromium prevent white powder corrosion in accelerated tests. On the basis of these tests and the high humidity tests, the cadmium-nickel-chromium combination appeared superior to the cadmium-tin or cadmium-nickel combinations which seem to have about equal value.
6. The composite coatings containing cadmium gives protection against rusting in a highly humid atmosphere which is superior to that afforded by copper-nickel or copper-nickel-chromium coatings of the thicknesses tested (Table I).

Field tests are now in progress which will show, in a few years, the true value of the finishes discussed here.

References

[1]Gustaf Soderberg, "Problems in Cadmium Plating". Mo. Rev. Am. Electroplaters' Soc. 17, No. 8, 30–31 (1930).

[2]H. L. Cobb, "Cadmium Whiskers". Mo. Rev. Am. Electroplaters' Soc. 33, No. 1, 28–30 (1946).

SOME METALLURGICAL ASPECTS OF ELECTRODEPOSITS

CARL E. HEUSSNER* A. R. BALDEN L. M. MORSE

Materials Testing Laboratory, Engineering Division, Chrysler Corporation, Detroit, Michigan

Continued from June Issue

Internal Stress

One of the most interesting characteristics of electrodeposits is that many of them are deposited in a condition of stress. Barklie and Davies in 1930 reported a method for the quantitative measurement of stress in an electrodeposit[11] and gave data on the stress in deposits of various metals. Marie and Thon reported similar work in 1932[12]. Recently, several investigators have undertaken the study of the causes and effects of stress in deposits[14, 15].

The method used by the several investigators is basically the same. A thin strip of metal is plated on one side only; if the plated side becomes concave, there is tensile stress in the deposit, if it becomes convex, the stress is negative or compressive. Knowing the base metal and the deposit thicknesses and measuring the curvature, one may calculate the stress.

Table V shows some of the results reported in the literature.

The technique used by the present writers consists of plating one side only of a steel strip, 0.5 x 6 x 0.020 inch. The back of the strip is stopped off with "Duoplastix" lacquer and the strip is held rigidly for plating in the center of a 3 x 8 inch panel by means of two short overhanging clips. After plating, the curvature and the plating thickness is measured. In all the tests, the plate thickness is held between 0.0009 and 0.0011 inch. Six measurements are made on each specimen at intervals of one inch, and these are averaged using a special method of weighting the individual readings according to their distance from the center of the six-inch strip. In addition, four separate specimens are plated for each condition under study and the results with all averaged.

The deflection is measured in a special jig shown in Figs. 20 and 21. It consists of a Lucite frame of 6-inch inside length with three electrical contacts along the back. The tip of a micrometer screw makes a fourth contact. Current is supplied by a 90-volt "B" battery. When the ends of the strip touch the two end contacts and the micrometer screw just touches the center of the strip, two tiny neon lamps light. Electronics engineers, in fact, say that the micrometer does not even have to touch the strip because the 90 volts will jump a gap of about 40 millionths of an inch.

The curvature of every strip is measured both before and after plating and the difference is employed in the calculations.

The formulas used by various investigators are somewhat different and lead to slightly different values. Barklie and Davies' formula for stress in deposits is

$$s = \frac{4E_b t_b^2 \Delta}{3t_c l^2}$$

where t_b = thickness of base metal strip
t_c = thickness of coating
E_b = Young's modulus of elasticity for the base metal
Δ = deflection in the center of the arc
l = length of the arc

Soderberg and Graham's formula for nickel on steel, which are assumed to have the same Young's modulus E, consists of two terms: a first term for the total stress in the uncurved strip as it is calculated from the deflection, and a second term correcting for the stress introduced by the cooling of the bimetallic strip on removal from the plating bath. It can be written

$$s = \frac{4E(t_b + t_c)^3 \Delta}{3t_b t_c l^2} + \frac{E(\alpha_b - \alpha_c)(T - T_o)(t_b + t_c)^2}{(t_b + t_c)^2 + 3t_b t_c}$$

*Heussner mispelled in June Issue

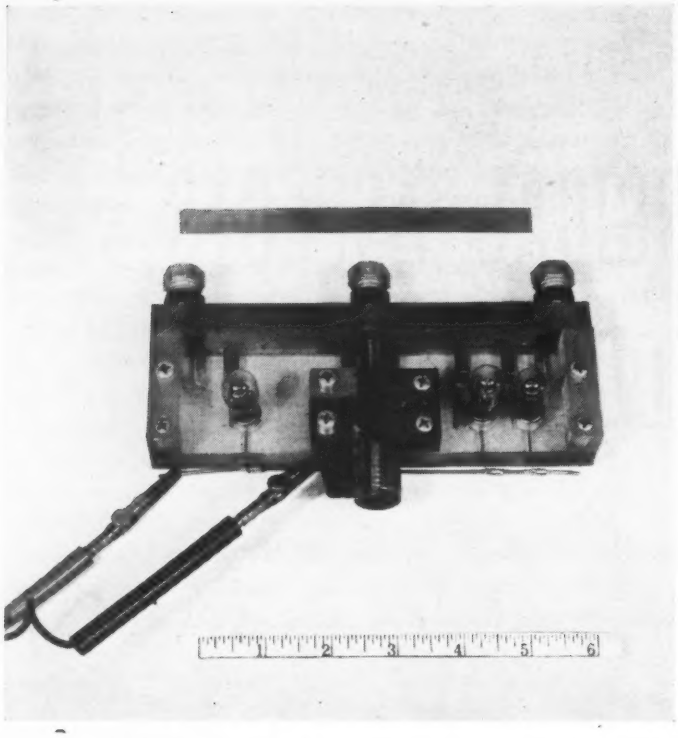

Fig. 20. Instrument for measuring curvature of stress specimens

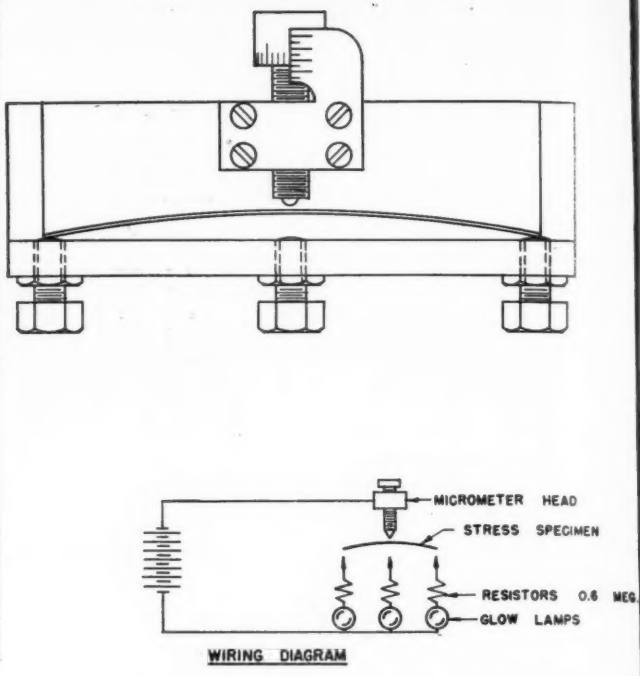

Fig. 21. Schematic view of and wiring diagram for instrument for measuring curvature of stress specimens

where α_b and α_e = temperature coefficients of linear expansion of the base metal and the coating, respectively

T = temperature at which results are to be applied

T_o = temperature of observation

A recent calculation by E. Parker of the Chrysler Applied Physics Department gives a stress s_f in nickel on steel when the strip has flexed

$$s_f = \frac{E_b\, t_b^3\, \Delta}{3t_e(t_b + t_e)l^2}$$

This formula gives about the same stress as the Barklie and Davies' formula, but is more accurate for heavy plate thickness.

It is important to define in what stress we are interested. If the test strip is held rigidly during plating and then released, it becomes curved. The curving has transferred some of the stress to the steel and the stress in the plated layer has been lowered. Since most plated parts are rigid enough not to flex during plating, we are more interested in the stress present in the plate before it is released.

Parker provides a temperature correction and an increment to calculate the stress in the deposit when the piece cannot deflect.

The following formula by Parker gives the value for the stress s_r in the rigidly held piece in terms of the deflection when the piece has flexed:

$$s_r = s_f + \frac{4E_c t_b\, \Delta}{l^2}$$

There E_c = Young's modulus of elasticity for the plated coating

When the curvature is measured at one temperature T_o, the stress s_t at another temperature T will be:

$$s_T = s_f + E_b(\alpha_b - \alpha_e)(T - T_o)$$

The values of the stress increment caused by temperature are negative because nickel is plated above room temperature and its expansion coefficient is higher than that of steel. The values are relatively small, however.

The complete formula used by the present author was, therefore:

$$s = \frac{4E_b t_e^3\, \Delta}{3t_e(t_b + t_e)l^2} + \frac{4E_c t_e\, \Delta}{l^2} + E_b(\alpha_b - \alpha_e)(T - T_o)^*$$

No correlation was observed between grain structure and stress, between hardness and stress, or between ductility and stress. An attempt was made to discover the factors influencing the stress produced in nickel deposits. A standard bath of Watts type composition was used. The concentrations of the bath components

*Combining the first two terms and assuming $E_b = E_c = E$ one obtains

$$s_r = \frac{4E\,(t_b^3 + 3t_b^2 t_c + 3t_b t^2{}_c)\Delta}{3t_c(t_b + t_c)l^2}$$

which differs from the first term of the Soderberg-Graham formula only by $t_b/(t_b + t_c)$, t_c^3 being negligible—(EDITOR).

TABLE V. STRESS VALUES REPORTED IN LITERATURE

Deposit	Type of Bath	Stress 1000 psi	Investigator
Nickel	Nickel ammonium sulfate	36.4–38.4	G. G. Stoney, 1909
Nickel	Nickel sulfate, 250 g/l Boric acid, 30 g/l Sodium fluoride, 8 g/l Potassium chloride, 3 g/l *p*H 5.7, 10 asf, 20° C	26.3	Barklie & Davies, 1930
Copper	$CuSO_4.5H_2O$, 200 g/l H_2SO_4, 60 g/l 30 asf, 35° C	Practically zero	Barklie & Davies, 1930
Zinc	Zinc sulfate, 143 g/l Sodium acetate, 0.25N Gum arabic 10 asf, *p*H 4.3, 18° C	−4.0*	Barklie & Davies, 1930
Lead	Basic lead carbonate, 150 g/l 50 per cent hydrofluoric acid, 240 g/l Boric acid, 105 g/l Glue, 0.2 g/l 10 asf, 18° C	Practically zero	Barklie &Davies, 0900
Nickel	As above, DC 10 asf, AC–DC 22 asf	8.3	
Nickel	As above, DC 10 asf, AC–DC 35.7 asf	4.95	

*Negative value = stressed in compression.

were varied, one at a time with the others being held at the standard values and were found to have little or no effect on stress. Likewise, the temperature and current density were varied, giving moderate changes in the stress observed. The baths used were all first carefully purified until spectroanalysis showed metallic impurities to be present only as traces; less than 2 ppm of copper, iron and zinc were present.

The effect of the common operating variables on the stress is shown in Table VI. All results were rounded off to the nearest 100 pounds.

It may be noted that the factors which are known to increase polarization such as reduced agitation or increased current density result in higher stress than that observed with the standard condition. Variables known to reduce polarization, increased temperature, decreased current density, reduced the stress. This is in accord with the findings of Soderberg and Graham and of Barklie.

The effects of impurities in the bath and of some other conditions are shown in Table VII. In the Watts type baths at a *p*H of 2.0, the addition of 100 milligrams per liter of various metallic impurities in each case caused increased stress. This amount of impurity also caused visible defects in the plate in each case. With the Watts type bath at a *p*H of 4.75 the same amounts of these impurities had a still stronger effect and very poor deposits were produced. For this reason, smaller amounts of impurities were used and were found to have a strong effect on stress. Zinc gave the greatest increase in stress of the metallic impurities studied.

Table VIII shows some stress data on deposits from other nickel baths as well as estimated stress in two iron-nickel alloy deposits. The concentration of chloride in a gray nickel bath seems to affect the stress markedly; there appears to be a minimum value between zero and 12 oz/gal of nickel chloride.

An organic addition agent present in some bright nickel baths reduces stress considerably, even reversing it, i. e., making it compressive. This effect was also observed in the iron-nickel bath.

Adhesion

The adhesion of a deposit to the base metal is most important to the final quality of the product. Adhesion can be accomplished through interatomic forces or through mechanical interlocking of the coating with the base metal surface.

It is usually considered that perfect adhesion requires intimate contact of the plated metal with the base metal. Not even a single layer of foreign atoms can be allowed between the two metals. When there is intimate contact, when the metals crystallize in the same system, and when the lattice parameters are of the same order of magnitude, the crystal structure of the base metal is often continued or simulated by the plated metal. Whenever this condition is observed, one can be quite sure of good adhesion.

Solid diffusion or alloying between the deposit and the base metal may also be an indication of intimate contact.

Even when these ideal conditions are met, there may be a poor "bond" due to one or more of three causes:

1. The structure of the base metal may have been weakened during its preparation by polishing, buffing, grinding, or excessive chemical attack.
2. The initial metal deposit may be disorganized, spongy, or otherwise weak.
3. A weak or brittle intermetallic compound may have formed by alloying.

Any of these causes can produce a weak layer which will separate at or near the interface during an adhesion test.

When due care has been exercised to avoid these pitfalls, remarkable adhesion can be and is being obtained. Measurements of adhesive force on properly prepared deposits will usually result in failure in the weaker of the two metals and not at the bond.

Effect of Physical Properties and Conditions on Appearance, Corrosion Resistance and Fatigue Life

When used decoratively, plated coatings function not only to enhance the eye appeal of the finished product on the sales floor, important as this is, but also to enable the product to retain that eye appeal in service. The means by which various physical properties and conditions may be varied have been discussed. How they may affect the appearance and corrosion resistance will now be considered.

It can be easily seen from studying the *crystal structure* of a nodule that it is a metallographically weak part of a deposit. During buffing of the deposit to smoothen it for subsequent treatment the possibility of dislodging nodules is very real. Further, since these formations may have started to form early in the plating, their removal will leave small local areas with a very thin deposit or none at all. Because the protection offered steel by nickel is dependent upon it being continuous and free from pores, a nodulized deposit will be very unsatisfactory and should be rejected by the inspector. A fine grained deposit free

TABLE VI. STRESS IN NICKEL DEPOSITS FROM A WATTS TYPE BATH

Standard bath composition: 40 oz/gal nickel sulfate, 6 oz/gal nickel chloride, 4 oz/gal boric acid, *p*H 2.0.
Standard operating conditions: Temperature 120° F, current density 40 asf, agitation 70 2-inch strokes per minute.

Variation from Standard	Tensile Stress, 1000 psi test specimen	
	flexed	rigid
Standard	8.5	9.8
60 asf	9.9	11.2
200 asf	6.6	7.6
140° F	5.6	6.6
170° F	5.9	6.8
3.5 oz/gal boric acid	7.9	9.2
No agitation	12.0	14.0
100 ppm H_2O_2	8.1	9.2

TABLE VII. STRESS IN NICKEL DEPOSITS FROM WATTS TYPE BATH CONTAINING IMPURITIES

Standard composition and operating conditions: See Table VI

*p*H	Impurity ppm	Tensile Stress* 1000 psi
2.0	None	9.8
	Cu^{++}, 100	16.0
	Fe^{++}, 100	15.4
	Fe^{+++}, 100	13.5
	Zn^{++}, 100	28.2
	Na-oleate, 100	11.5
3.8	None (150° F)	14.0
4.75	None	12.2
	Cu^{++}, 25	12.2
	Cu^{++}, 50	16.7
	Fe^{++}, 100	20.2
	Fe^{+++}, 100	18.2
	Zn^{++}, 100	24.3
	Na-oleate, 100	18.3
	H_2O_2, 200	47.5

*Stress in rigidly held specimens.

TABLE VIII. STRESS IN NICKEL AND NICKEL-ALLOY DEPOSITS FROM A VARIETY OF BATHS

No.	Bath	Stress, 1000 psi
1	Watts type (40–6–4), *p*H 2	9.8
2	High-chloride (40–12–4)	18.1
3	All-sulfate (40–0–4)	13.0
4	Iron alloy	70.5
5	No. 4 with a naphthalene sulfonate	18.2
6	Bright, A	0.5
7	Bright, B	−7.0*
8	No. 1 with 0.46 oz/gal cobalt sulfate	13.6
9	No. 8 with 0.33 oz/gal formalin	11.3
10	No. 9 with 3 per cent formic acid	14.9
11	No. 10, but at *p*H 3.75	29.8

*Negative value = stress in compression.

from nodules, on the other hand, will tend to duplicate the base metal surface and can be brought to a high luster with minimum labor cost. Still better, of course, considering labor costs, is to have a submicroscopic grain structure as plated from a bright plating solution which, properly applied, will require no coloring. Such deposits do, however, have other inherent weaknesses which will be discussed later.

The *porosity* of a deposit may be evident enough to be noticed on casual inspection by an untrained observer, or the pores may be microscopic and detected only by means of a chemical test. Although the large pores are most seriously objectionable on a newly plated product, the microscopic pores may well have just as serious effects on the corrosion resistance of the part. A pore may extend only part way into a deposit, or it may extend to the base metal itself for reasons already discussed. It may be partially or wholly bridged over during buffing, but this bridge would afford very little protection against corrosion and such an apparently good deposit would fail rapidly.

A common shortcoming of commercial bright plating solutions is that the resulting deposit may be *laminated*, i. e., consist of layers of the metal separated by weaker layers considered to be high in organic materials. These weaker layers often cause the deposit to separate into layers when under stress, leaving a much smaller effective thickness of deposit. Frequently, corrosive conditions give rise to failure at one of the laminations, permitting the unsightly peeling so often observed, which may be falsely considered to be due to poor adhesion. A combination of porosity and inadequate adhesion will also cause the deposit to blister due to the force exerted on the coating by the large volume of corrosion products.

One of the most valuable properties that a coating may have is high ductility, allowing it to be formed or drawn after plating. The *brittleness* of a deposit may be so severe, on the other hand, that the stress produced when tightening nuts on assembling will cause the deposit to crack. If accompanied by poor adhesion, large sections of the deposit may flake off under such conditions. Even if the deposit is adherent, the base metal will be exposed at the crack, leading to early corrosive attack and failure of the part.

The war stimulated the use of plating coatings for salvaging worn or mis-machined parts and for increasing the life of parts subject to severe wear. Frequently, it was desirable to fabricate a part which would have good wear resistance and yet be light. Here was an ideal use for an electrodeposit.

There are many factors inherent in the coating which will contribute to satisfactory mechanical performance of a plated part if the problem is given proper thought and the plating done under carefully controlled conditions. If unwisely chosen or improperly applied, the use of the same coating may lead to premature failure of the part in service.

The *hardness* required in any given application can frequently be estimated from a knowledge of the function of the part. Often, however, it is desirable to run some tests to determine it. Metals used to build up worn parts range from the very soft to the very hard and include copper, silver, nickel—soft and hard—and chromium. Hardness and *coefficient of friction* are very important factors in the resistance to wear. A hard metal plated over a softer metal will give the same effect as the carburized layer on steel.

High elongation is desirable since it reduces danger of formation of cracks in the deposit and thus minimizes the danger of premature fatigue failure.

It has been demonstrated[11] that a nickel deposit under tensile *stress* will considerably reduce the fatigue life of a plated part subject to repeated stresses and that the reduction is proportional to the stress in the deposit. A hard deposit with a low *endurance limit* will likewise cause premature failure of the base metal.

It is evident that poor adhesion of the electrodeposit to the base metal would in itself constitute failure, but the effect of poor adhesion may be serious for other reasons. Thus, for example, a flaking deposit of a hard metal such as hard chromium may seriously score a mating surface.

Hydrogen embrittlement due to plating has been known for some time to be capable of causing failure of hardened, high carbon steel parts[12]. It is important in plating parts susceptible to hydrogen embrittlement that the preplating cycle be free of any step which could load the steel with hydrogen and that the actual plating conditions be such that the maximum cathode efficiency be maintained. Knowledge of adequate annealing treatments to drive off any hydrogen absorbed during plating is a must with any plater hoping to process such parts successfully.

We have discussed at some length the common types of structure of plated deposits and have attempted to show how physical properties can be related to structure. We have also discussed physical properties and structure in the light of the effect they can have on the ultimate use and service life of the coating. It is, of course, impossible to touch on all of the many ways in which the properties of the deposits may influence their suitability or quality in a given aplication. Many special properties may be obtained by the use of duplex or multiple deposits, by diffusion or annealing after plating, and by chemical or mechanical post treatments. Although a number of "negative" qualities have been mentioned in this article, the desirable properties which are obtainable through the use of plating processes are far more numerous.

It has already been stated that the application of the scientific attack to problems of plating is fairly recent; there is still a vast amount of work to be done and much knowledge to be gained concerning the interrelationships of all the factors discussed. The American Electroplaters' Society in its Research Program is making a commendable start along this line in its projects on the Effects of Impurities in Plating Baths, Removal of Impurities, Physical Properties of Electrodeposits, Adhesion, Cleaning and others. We can hope

(*Continued on page 768*)

project no. 3

a. e. s. research

project director:

A. L. FERGUSON

associate:

M. V. TSAO

location:

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICH.

Acknowledgment is due the Research Committee, Mr. C. Heussner, Chrysler Corporation, Chairman; the Research Directing Committee, Dr. R. M. Wick, Bethlehem Steel Company, and Dr. Louis Weisberg, Consulting Chemist, New York City, Chairman and Vice-Chairman, respectively; and the Project Committee, Dr. R. B. Saltonstall, The Udylite Corporation, Chairman; Mr. F. C. Mesle, Oneida, Ltd., and Mr. E. Hahn, Ainsworth Manufacturing Company, for their contribution to this project.

Adhesion of Electrodeposits

VI. Determination of Adhesion Through The Use of Cement

Introduction

Previously stated considerations have indicated that the most satisfactory quantitative method for determining adhesion probably would be one that would make use of a direct pull perpendicularly to the surface. This requires that a "handle' of some sort be attached to the deposit.

It has already been shown (*Mo. Rev. Am. Electroplaters' Soc. 33*, 1301 (1946)) that soldering is unsuitable for this purpose unless the part is expected to withstand soldering temperatures in service.

The tests reported here were undertaken to determine if any of the high-strength cements developed during the recent war would serve as a means for attaching the "handle".

Test Methods

Some of the preliminary tests were made with 1 x 6 x 1/16 inch metal strips cemented together with overlapping 1 sq.in. areas. The free ends (with $\frac{3}{8}$ inch diameter holes) were pulled in a tensile test machine to measure the shear strength of the bond. This method was abandoned when it was discovered that with the higher strength joints the strips bent where the overlap ended (Fig. 1), thus subjecting the joint to a can-opener action instead of true shear.

The remainder of the tests were performed, therefore, with $\frac{1}{2}$ inch diameter, $\frac{5}{8}$ inch long cylinders of brass or steel having flat ends that were cemented together two and two. The specimens were gripped in the tensile test machine by adaptors attached through a threaded hole in the free end of each specimen (Fig. 2).

No attempts were made to test the adhesion of any plated coating.

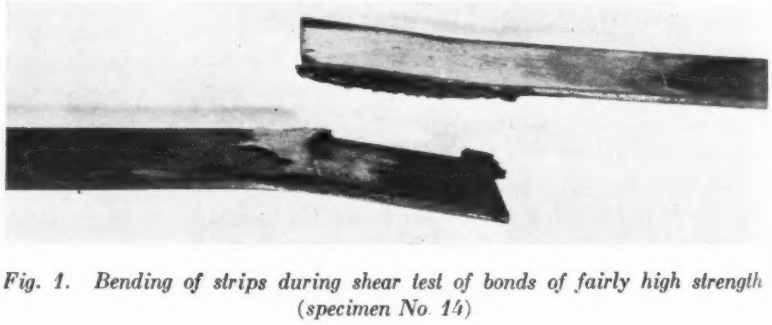

Fig. 1. Bending of strips during shear test of bonds of fairly high strength (specimen No. 14)

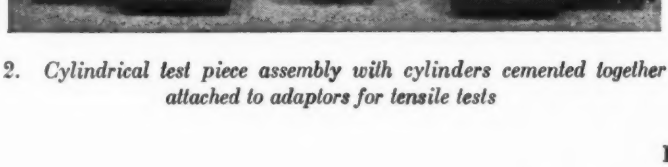

Fig. 2. Cylindrical test piece assembly with cylinders cemented together and attached to adaptors for tensile tests

TABLE I. CEMENTS TESTED

Designation	Source
Metlbond M3c	National Research and Manufacturing Company, 2330 Cleveland Avenue, National City, Calif. (developed under the auspices of Consolidated Vultee Aircraft Corporation)
Durite S-3024Y	Durite Plastics, Inc., Frankford Station P. O., Philadelphia 24, Pa.
Bakelite XJ16320	Bakelite Corporation, Bloomfield, N. J.
Pliobond	United States Plywood Corporation, Industrial Adhesives Division, 25 W. 44th Street, New York 18, N. Y. (manufactured by Goodyear Tire & Rubber Company)
Cycle Weld, C-3 Brush Type	Chrysler Corporation, 8021 Conant Road, Detroit, Mich.

TABLE II. RESULTS OF TESTS WITH METLBOND M3c, DURITE S-3024-Y, AND BAKELITE XJ16320 ON SHEET IRON STRIPS

Drying conditions as recommended by the manufacturers, for Durite a few minutes at room temperature

Test No.	Cement	Cleaning Procedure*	Curing			Bond Shear Strength, psi
			° C	psi	min.	
1[1]	Metlbond	R, C	100	1000	25	0†
2	Metlbond	R, C	100	600	25	200
3	Metlbond	R, C	168	500	30	1310
4	Metlbond	R, C	168	1000	30	1150
5–7[1]	Metlbond	R, C	170	500–2000	30 (?)	almost constant
8[1]	Metlbond	R, C, E	170	1000 (?)	30 (?)	1550
9[1]	Metlbond	R	170	1000 (?)	30 (?)	650
10[2]	Durite	R	145–155	300	60	550
11[2]	Durite	R, C, E	145–155	300	60	1555
12–13‡[1]	Metlbond	R, C, E	170	1000 (?)	30 (?)	1450; 1500
14[1]§	Metlbond	R, C, E	170	1000 (?)	30 (?)	1750
15[3]	Durite (?)	R, C, E	145–155 (?)	300 (?)	60 (?)	1600
16[4]	Durite (?)	R, C, E	145–155 (?)	300 (?)	60 (?)	1800
17[5]	Metlbond	R, C, E (?)	170 (?)	1000 (?)	30 (?)	1500
18[5]	Durite	R. C. E (?)	145–155 (?)	300 (?)	60 (?)	1500
19[5]	Bakelite●	R, C, E (?)	150 (?)	1000 (?)	?	700
20[5]	Bakelite♦	R, C, E (?)	150 (?)	1000 (?)	?	1250

*R = rust removal with steel wool or acid or both followed by tetrachlorethylene degreasing, C = cathodic electrocleaning followed by anodic electrocleaning, E = electropolishing.

†Cement not cured, all other failures due to poor adhesion except in Test No. 16 which was caused by poor cohesion of the cement (See Fig. 9).

‡Variations in electropolishing.

§Recommended electropolishing procedure.

●Cut with 3 parts of acetone and 1 part alcohol; excessive bubble formation during drying.

♦Cut further with absolute alcohol; still many bubbles.

[1]Cement applied by spraying up to 10 coats.

[2]Cement applied by spraying 8 coats at 3-minute intervals.

[3]Cement applied with glass rod.

[4]Cement applied by repeated dipping, each application being followed by 15-minute air drying with the strip in horizontal position.

[5]Cement applied by dipping, cycle unknown.

Results

All the experimental data have been tabulated in Tables II, III and IV.

A number of factors were found to determine the bond strength: the type of cement used, the preparation of the metal surface, the solvents used with the cements, the techniques in the application of the cements to the surface, and the conditions for drying and curing the cements. These will be presented in order.

Type of Cement.—Following conferences with manufacturers or users or both, five cements were chosen for tests. These are listed in Table I.

With the exception of the Bakelite cement, which is a clear resin, the resins are opaque, rubber-like substances.

The number of specimens tested was not large enough to justify definite conclusions concerning the relative merits of these cements. Most of the work was done with the Bakelite cement and the best results were obtained with it.

Surface Treatment.—The tests with the iron strips were carried out with the Metlbond and Durite cements according to the directions of the suppliers and the conditions of curing found best in preliminary tests.

It was found that while steel wooling plus trichlorethylene vapor degreasing gave a shear strength of only 550 and 650 psi (Tests Nos. 10 and 9) for the two cements respectively), the addition of electrocleaning, anodic or cathodic or both, and acid dipping raised the bond strength of the Metlbond cement to 1,150–1,310 psi (Tests Nos. 4 and 3). The further addition of electropolishing raised it to 1,450–1,750 psi for both cements (Tests Nos. 8, 11–14).

The preferred electropolishing bath contained, by volume, 40 per cent sulfuric acid, 46 per cent phosphoric acid, 4 per cent dextrose, and 10 per cent water. Operated at 25° C (77° F) and 700 asf, it gave the highest bond strength set forth above.

The surfaces of the cylinders to which cement was to be applied were freshly machined without the use of oil. They were then trichlorethylene degreased in a specially designed apparatus (Fig. 3) which provides both vapor-phase treatment and flushing with newly condensed liquid. Omission of the degreasing caused a considerable drop in the bond strength obtained with the Bakelite cement (Tests Nos. 34–41).

Solvents for Bakelite Cement.—The Bakelite cement, because of its thick consistency, caused much difficulty in application. The original material was cut with a mixture of alcohol and acetone, but

because of excessive bubble formation during curing, it was replaced with uncut material to which were added a number of solvents.

Bubble formation in the cement during preliminary evaporation and during curing proved to be the most serious difficulty with the Bakelite cement. The presence of the gas bubbles greatly reduced the area of the cross section of the joint and hence the total bond strength.

Once, in Test No. 26, the rather high bond strength of 4,600 psi was obtained without the use of solvent, but when the test was repeated in Test No. 48 under apparently exactly the same conditions, the bond strength dropped to 1,210 psi, apparently due to the presence of larger and more numerous bubbles. Another attempt, Test No. 52, in which the curing time was increased, gave a bond strength of 2,720 psi.

Best result was had with N-butanol. The maximum bond strength, 5,900 psi, was had in Test No. 63 with steel cylinders. Repeated tests under the same conditions not given in Table III gave similar results, one as high as 6,700 psi. With brass cylinders 4,000–4,900 psi was obtained in Tests Nos. 57, 50, and 56. Although the steel specimens showed rust spots forming during drying, they gave more uniform results than the brass specimens.

Techniques in Applying the Cement.—In the beginning the Metlbond cement was applied by repeated spraying to build up the required thickness. Later it was found that dipping gave equally good results. In general the same was found true with the Durite cement. (See Table II.)

TABLE III. RESULTS OF TESTS WITH BAKELITE XJ16320 CEMENT DIPPED ONTO BRASS CYLINDERS
Freshly machined surfaces cleaned with steel wool and with trichlorethylene vapor and freshly condensed liquid

Test No.	Diluent vol.-ratio	Drying		Curing			Bond Tensile Strength psi	Type of Failure*
		° C	hr.	° C	psi	min.		
21[1]	ethanol†, 5:1	room	20	130–150	1000	10	1360	C
22[2]	ethanol†, 5:1	room	20	130–150	1500	10	near 0	I
23[1]	ethanol†, 5:1	room	20	130–150	low	10	1440	I
24[1]	ethanol†, 5:1	room	20	130–150	v. low	10	1660	I
25	None	room	20	130–150	‡	30	1600	C
26	None	room	20	170–190	‡	15	4600	C
27	None	room	20	190–225	‡	30	1120	
34–36[3]	ethanol†, 5:1‡	room+ oven		170–190‡	‡	15‡	<1000	A
37–38[3]	ethanol†, 5:1‡	room	short	170–190‡	‡	15‡	<1000	A
39–41[3]	ethanol†, 5:1‡	room	long	170–190‡	‡	15‡	<1000	A
42	iso-propanol	room	20	160–185	‡	30	1500	
43	N-butanol	room	20	160–185‡	‡	30‡	640	A
44	N-butanol, more	50–60	⅓	160–185‡	‡	30‡	960	A
45	N-butanol, same	50–60	⅓	160–185‡	‡	30‡	2400	A
46	N-butanol, 6:1	room	20	160–185‡	‡	30‡	3200	C
47	N-butanol, 6:1	room	30	160–185‡	‡	30‡	3360	C
48[4]	None	room	20	170–190	‡	15	1210	C
49[5]	N-butanol, 6:1‡	room	30‡	160–185‡	‡	30‡	2720	A
50[6]	N-butanol, 6:1	room	20	160–185‡	‡	30‡	4500	A, C
51[7]	N-butanol, 6:1	room	20	160–185‡	‡	30‡	2850	
52[8]	None	70	24	170–190	‡	30	2720	A, C
54[6]	N-butanol, 3:1	room	15	160–185‡	‡	20	near 0	I
55[6]	N-butanol, 3:1	room	20	160–185‡	‡	30	3040	
56[6]	N-butanol, 3:1	room	20	160–185‡	‡	30	4900	
57[6]	N-butanol, 3:1	room	20	150–175‡	‡	30	4000	
58[6]	N-butanol, 3:1	room	20	150–175‡	‡	20	1040	
59[9]	N-butanol, 6:1	room	40	150–175‡	‡	20	2700	
60	N-butanol, 3:1	room	40	150–175‡	‡	20	2050	
61	N-butanol, 3:1	room	40	150–175‡	‡	20	1920	
62[10]	N-butanol, 2:1	room	15	160–185‡	‡	30‡	1120	A, C
63[10]	N-butanol, 2:1	room	20	160–185‡	‡	30‡	5900	A, C

*A = poor adhesion, C = poor cohesion, I = poor adhesion because of insufficient curing.
†95 per cent.
‡Original data not entirely clear, curing pressure probably very low.
[1]Cement applied with glass rod.
[2]Cement applied with glass rod and dried under large funnel.
[3]Steel wooling only, no degreasing.
[4]Conditions duplicate those for Test No. 26, but larger and more bubbles formed in the cement.
[5]Cement layers more than twice as thick as before.
[6]Cement layers of more uniform thickness obtained by drying with cylinders on 45° motor shaft.
[7]Duplicate of Test No. 46.
[8]Cement dried after cylinders had been assembled for curing.
[9]Cement fracture shows no bubbles but is powdery and lighter in color than usual.
[10]Test run with steel specimens; rust spots grew during drying.

In a few of the early tests the Bakelite cement was applied with a glass rod (Test Nos. 21–24). However, it was soon abandoned for a dipping technique in which the flat surface of the cylinder was lowered into the cement at an angle so as to prevent entrapment of air bubbles in the cement layer.

Because of their thin consistency, the diluted Bakelite cements tended to form a ridge near the circumference of the cylinder. This was avoided by turning the cylinder slowly at 45° with the horizon until the cement had thickened by evaporation of the solvent (Fig. 4). The more uniform thickness obtained in this manner gave substantially improved results (Test Nos. 50, 54–58).

The rotation technique developed for the Bakelite cements was not used with the Pliobond or Cycleweld cements (Table IV).

Drying of Bakelite Cement.—To eliminate too rapid drying as a source of bubble formation, the cylinder after it had been coated and the cement had set was put with the cemented area upwards under a small bell jar cover of a volume of 3 to 5 times that of the cylinder (Fig. 5). The bell jar cover was removed after 5 hours, and after another 15 hours without cover, the cement was almost free from solvent. This method gave higher bond strength than oven drying for 20 minutes at 60° C followed by 20 hours air drying, in spite of the fact that this latter procedure removed all of the solvent and gave a bubble-free surface prior to curing. The effect of drying conditions is further illustrated in Fig. 6, in which are shown some specimens with Bakelite cement, originally diluted with N-butanol, dried and subjected to curing.

Curing of Bakelite Cement.—Since the cement is in a fluid state during curing, a loose-fitting sleeve was placed around the assembled cylinders to hold them in place. For ease of removal the sleeve

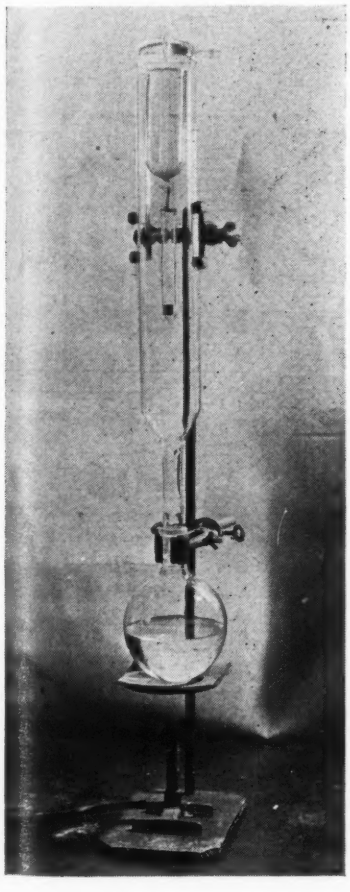

Fig. 3. Degreasing apparatus. Note the water filled condenser at top from which clean liquid passes over the brass cylinder which is placed in the test tube with a hole in the bottom

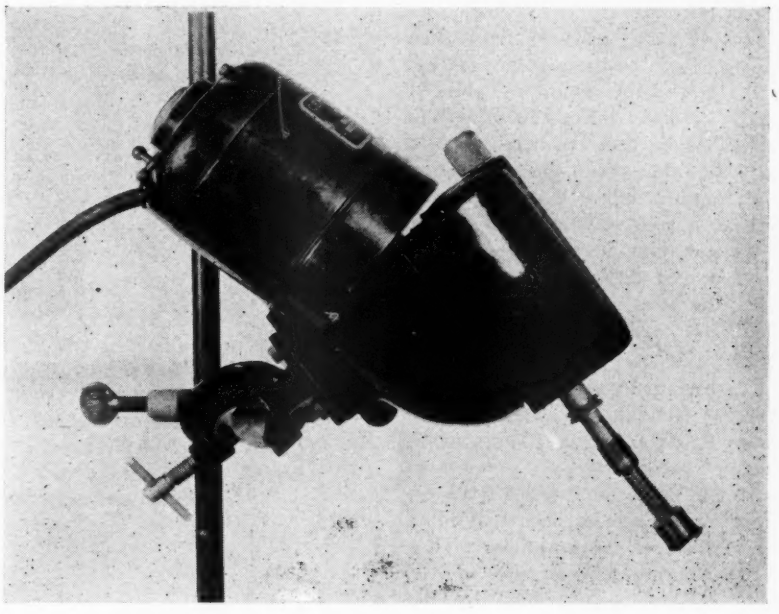

Fig. 4. Arrangement for uniform distribution of cement layer during setting of cement

TABLE IV. RESULTS OF TESTS WITH PLIOBOND AND CYCLEWELD C-3 BRUSH TYPE CEMENTS DIPPED ONTO BRASS CYLINDERS

Freshly machined surfaces, cleaned with steel wool and with trichlorethylene vapor and freshly condensed liquid

Curing conditions as recommended by manufacturers

Test No.	Cement	Drying		Bond Tensile Strength, psi	Type of Failure	Notes
		° C	hr			
28	Pliobond	room	20	near 0	Incomplete removal of solvent	Some bubbles
29	Pliobond	room followed by 70	20 1	770	Cement completely torn from one face	Clean face green, cured cement elastic
30	Cycleweld	room	15	350	Same	Clean face bluish
31	Cycleweld	room	15	920	Same	Same
32	Cycleweld	room	15	960	Same	No degreasing, no gas bubbles
33	Cycleweld	room	15	640		

was made in two parts with free space in between (Fig. 7). Following the curing the assembly was left in the press until the temperature had dropped to about 60° C for the same reason.

The three curing variables are pressure, temperature, and duration.

While theoretically the bond should hold as long as there is a continuous film of cured cement only a few molecules thick between the two cylinders, such did not prove to be the case in practice. An inspection of the results in Tables II and III, especially of Tests Nos. 21–24 in the latter, shows that the bond strength is definitely lower when so much pressure had been applied in the hydraulic curing press that a substantial portion of the fluid cement had been squeezed out. Since it proved difficult to control the pressure, the press was soon used merely to clamp the assembly lightly between the platens before the heat was applied.

The curing temperature is a major determining factor in the strength of the bond. It is, of course, the temperature in the cement layer that is important; to know it, one would have to place a thermocouple in the cement layer instead of on the surface of the assembly. Thus while the curing temperature of the Bakelite cement recommended by the manufacturer is about 150° C, best results were found with a *platen* temperature of 185 to 190° C. The central portions of the cement in Tests Nos. 22–24 which had been treated at a platen temperature of 130 to 150° C on tensile tests pulled out in long silk-like strings indicating incomplete curing. Since the samples also showed the effect of uneven heating, the platens were enclosed in an asbestos shield. In Test No. 27 which differs from Test No. 26 only in that the curing time was twice as long and the curing temperature 190 to 225° C instead of 170 to 190° C, the heating was too severe judging from the sharp drop in tensile strength.

The length of the curing time is also important, although not as critical as the curing temperature. About 30 minutes seemed generally sufficient at the preferred curing temperature with the apparatus arrangement employed in these tests.

Appearance of Torn Bonds

In general, the bonds may fail either because of poor adhesion of the cement to the metal surface or because of poor cohesion, i. e., strength, of the cement, itself. Both types of failure were observed in these tests and have been in the test series with Metlbond and Durite cements between sheet iron strips. Fig. 9 shows failures with the Bakelite cement applied on brass cylinders.

It should be noted that the highest bond strength requires both high adhesive and high cohesive strength of the cement. Lack of either reduces the bond strength, however high the other may be.

The pair of specimens to the extreme left in Fig. 9 illustrates the high strength that would be obtained, could the bubbles in the Bakelite cement be eliminated without other detrimental effects.

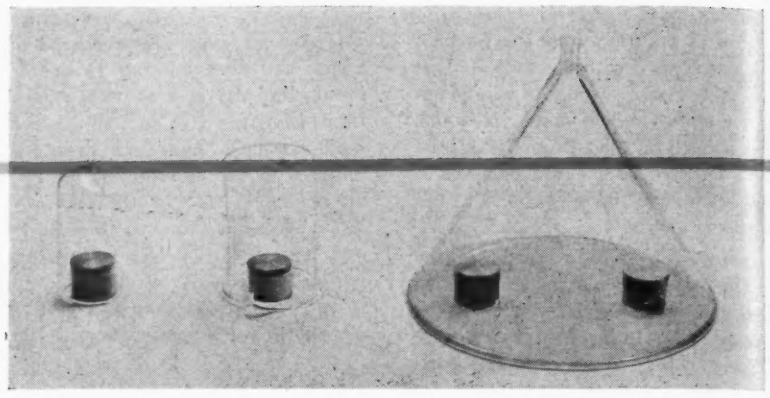

Fig. 5. Arrangement for retardation of air drying of cement. Progress of development of the method took place from right to left with decreasing size of bell jar

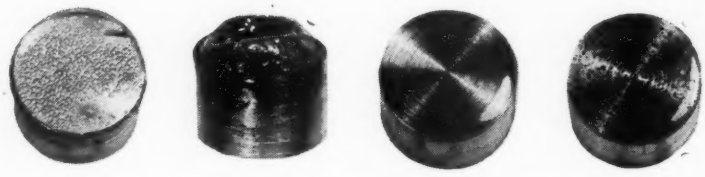

Fig. 6. Effect of drying conditions on bubble formation during curing of Bakelite cement containing N-butanol. From left to right: brass cylinder, air dried for 20 hours, on reaching 100° C curing temperature; same after curing at 180° C (note 0.5 cm high cluster of bubbles); brass and steel cylinders after 20-hour air drying, 2-hour oven drying at 55° C, and curing at 180° C (note absence of bubbles, and presence of rust spots on steel cylinder surface)

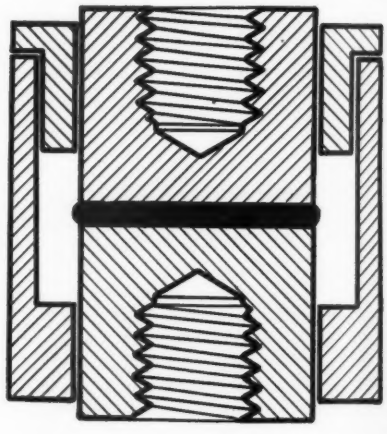

Fig. 7. Cemented cylinders with split guide sleeve ready for insertion in curing press

Conclusions

Since the tests reported here are only exploratory, no final conclusions can be drawn. The following, therefore, are general statements:

1. Careful cleaning is necessary prior to the application of any cement.
2. Close control of drying and curing conditions must be established.
3. With the cements used here the final test cannot be had in less than about 24 hours.
4. Bond strength of 4,000–6,000 psi have been obtained but not consistently, especially with brass, indicating need for further work to meet even such low requirements.
5. These results were had with Bakelite XJ16320 Cement, the other cements tested having given substantially lower values.
6. If bubble formation in the Bakelite cement could be prevented without other detrimental effects on adhesion or cohesion, much higher bond strengths seem possible, probably over 25,000 psi.

(*Figs. 8 and 9 on next page*)

Adhesion of Electrodeposits *(Concluded from opposite page)*

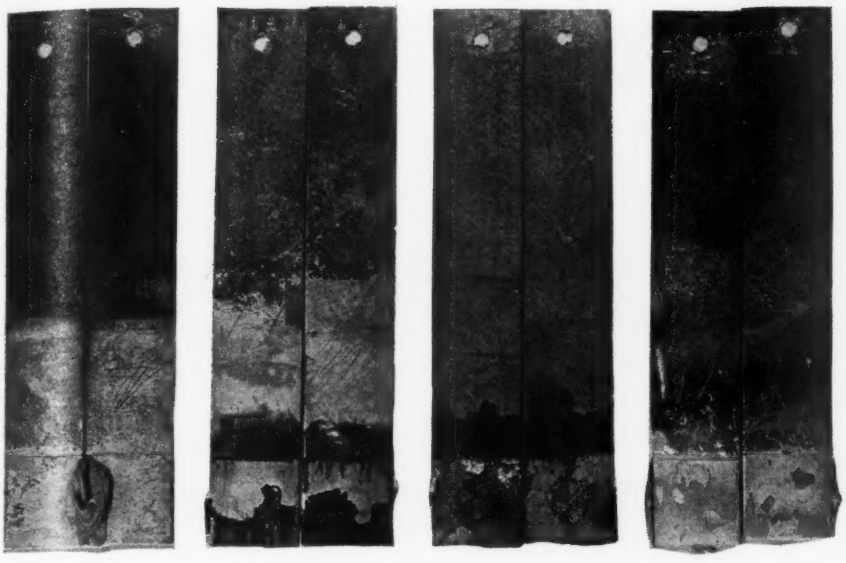

Fig. 8. Torn bonds. From left to right: Tests Nos. 3, 8 and 9 show examples of purely adhesion failures of the Metlbond cement; Test No. 16 shows mixed adhesion and cohesion failure of Durite cement

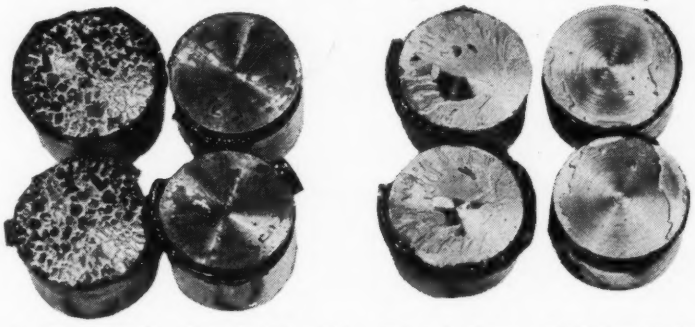

Fig. 9. Torn Bonds. From left to right: first pair shows a high strength bond which broke largely through cohesion failure in the fine cement network separating bubbles; remaining three pairs show typical adhesion failure

Correction: *The bibliography appearing on page 464 of May issue is part of the article on "Determination of Impurities in Electroplatinp Solutions IX (not VII as incorrectly printed) which ends on page 462 and does not belong to the article on "Stripping of Copper. IV".*

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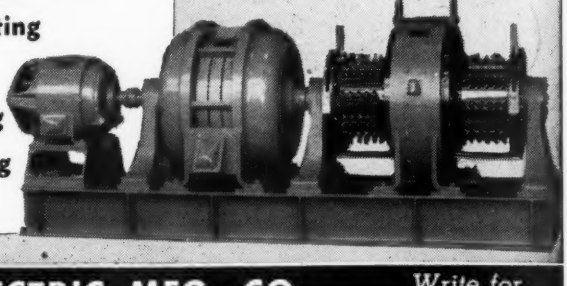

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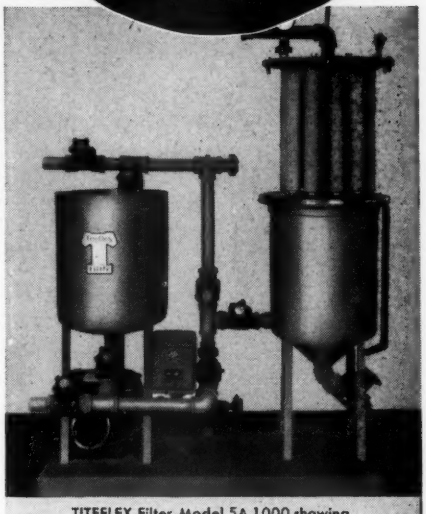

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The Question Box

a department devoted to readers' questions of general interest

Q. 21. What bath composition and procedures would you recommend for electropolishing of silver?

A. A process for electropolishing silver to reduce finishing costs is described by Daniel Gray of Oneida, Ltd., and S. E. Eaton of Arthur D. Little, Inc., in Metal Finishing **45**, 60–65 (May 1947) and Iron Age **159**, 64–65 (April 10, 1947). Process details are discussed and photographs of equipment and results are shown.—Other pertinent references are S. E. Eaton, U. S. Patent No. 2,416,294, February 25, 1947; R. Schuttleworth, R. King and Bruce Chalmers, Metal Treatment **14**, 161–163 (Autumn 1947); and an article in Western Machinery and Steel World **37**, 112 (July 1946).—C. L. FAUST.

Q. 22. At various times when I have used air agitation in my gray nickel bath I have noticed that I am compelled to use much greater quantities of peroxide to prevent pitting. The air is ordinary plant air run through a good oil separator. How can it be responsible for the greater consumption of peroxide?

A. For agitating plating solutions it has been found impractical to use plant air which has been highly compressed and then reduced. The high heat generated during compression of the air is believed to crack some of the lubricating oils, giving gaseous decomposition products which are not removed by an oil filter. Treatment with concentrated sulphuric acid and activated carbon are the only sure methods of purifying this air. The trouble is eliminated by supplying air for agitation from a low pressure blower.—B. C. CASE.

Q. 23. What causes nickel salts to crystallize on the anode bags in nickel plating baths?

A. In a plating circuit there is a normal lag in the diffusion of ions. This lag causes an increase in metal content around the anode. Inside the anode bag the metal concentration may rise to such a high value that the solubility of the nickel salt becomes exceeded and the salt crystallizes. The anode bag serves as nucleus for the crystallization, which, once started, proceeds from the inside to the outside of the bag. The use of more bath agitation or a larger number of anodes will tend to eliminate this difficulty.—R. A. SCHAEFER.

Q. 24. We have the problem of depositing on copper an impervious nickel coating which will withstand firing at 1350° F without blistering or destruction of the plate. What can you suggest?

A. After cleaning and rinsing, etch the copper surface in the conventional nitric-sulfuric-muriatic acid bright dip or electropolish if a smoother surface is desired. This treatment will remove any weak surface layer and thereby improve the bond. Then rinse thoroughly and plate in a suitable Watts type bath free from organic substances such as brighteners or wetting agents. Prevent pitting with small hydrogen peroxide additions. Experiment with nickel thicknesses 0.001 inch and up for required non-porosity.—K. G. SODERBERG.

A. I agree with Mr. Soderberg's recommendations and have only two precautions to add: (1) to aid in avoiding blistering, use oxygen-free copper, for example the OFHC grade, and (2) be very careful to keep the lead content of the plating solution below about 0.0025 g/l. Fig. 9 of my paper, "Physical Properties and Uses of Heavy Nickel Deposits", published in THE MONTHLY REVIEW for August, 1938, page 592, shows a 7-inch sauce pan made by forming and annealing a bi-metallic, 0.031-inch thick electroformed copper-nickel sheet.—W. A. WESLEY.

Q. 25. We have difficulty in plating enough copper in 45 minutes from a bath containing 2.5 oz/gal copper, 1.3 oz/gal free sodium cyanide, 4.9 oz/gal rochelle salt, 3.6 oz/gal sodium carbonate at pH 12.6 to buff out polishing marks on S. A. E. 1010 steel polished with No. 150 emery dry and No. 220 black emery grease without cutting through to the steel. The anodes turn several different colors when we use higher amperage. Please advise.

A. The bath composition appears satisfactory except that the free cyanide content is commonly kept at 0.75 to 1.0 oz/gal in this bath. Desired operating conditions are 20 to 40 asf at 130 to 150° F with cathode rod agitation. The anode behavior indicates that larger anode area may be necessary; the anode current density should not exceed 10 to 15 asf. The suggested changes should permit plating at higher current densities with higher efficiency.—A. K. GRAHAM.

Q. 26. Please tell me how to molybdenum plate?

A. It is doubtful that pure molybdenum can be electrodeposited. There are claims indicating that alloys of molybdenum with metals such as iron, cobalt or nickel can be so deposited. Unfortunately, no detailed papers have been published on the plating of such alloys.—W. BLUM.

Book Review

by DR. HAROLD J. READ,
Associate Professor of Metallurgy
The Pennsylvania State College

THE PLATING OF ZINC ALLOY DIE CASTINGS, published by the Zinc Alloy Die Casters Association, Lincoln House, Turl Street, Oxford, England. 1947, 132 pages. Price, 7s., 6d. L. A. J. Lodder, chief contributor.

This little book is of more than passing interest in that it summarizes much of the published information on the plating of zinc alloy die castings, and will be of use both as a source to those who have not the time or facilities for searching the literature, and as a guide for those who wish to read more extensively in this field.

The volume is divided into five parts which cover the production and cleaning of castings, the plating operation, the maintenance of plating baths, tests and specifications, and the stripping of plated coatings. The text is copiously annotated with references to the literature for which a bibliography of 121items isgiven.

Although the book will be found useful in a general way, a number of criticisms may be directed against it. Nowhere, for instance, did the reviewer find a discussion of the chemical composition of the basis metals—a bit of information which would seem to be fundamental.

The text is unbalanced in certain respects, e. g., in the chapter on bath maintenance rather explicit directions are given for purification procedures, but no information on analytical methods is presented.

The advertising blurb on the jacket promises a widely illustrated test. The illustrations turn out to be 14 beautifully printed pictures of finished products which are monotonous in themselves, and are of absolutely no use whatsoever as a source of information. There are no line drawings and no graphical presentations of data. The use of these at several places in the text would have been very helpful, and photographs of equipment would surely be more useful to the readers for whom the book is intended.

A more serious fault lies in the lack of critical evaluation of the material which is presented. This is not true of all parts of the book, but there are long passages where processes or methods are described with little or no indication as to which may be the most satisfactory in a given set of circumstances.

The appendix gives a flow sheet for four selected plating procedures which may be helpful if the reader can decipher it.

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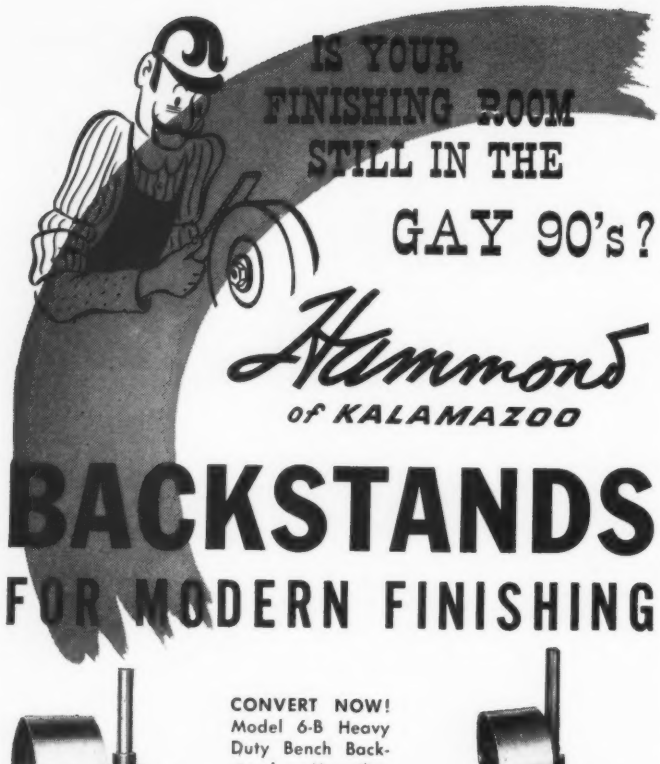

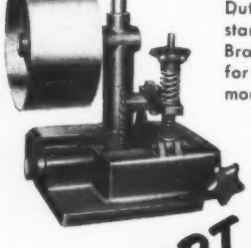

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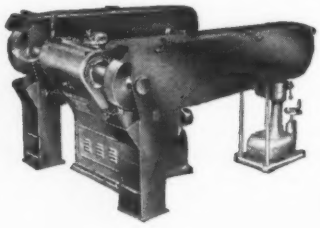

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Abstracts

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Pre-Treatment for Barrel Plating. Mari-Mazzone and Floyd McKnight. Metal Finishing **45,** 75–77, 82 (November 1947).
Gives practical recommendations for chemical and mechanical surface treatments prior to the plating operation.

A Note on the Electrolytic Polishing of Silver. R. Shuttleworth, R. King, and Bruce Chalmers. Metal Treatment **14,** 161–163 (Autumn 1947).
Describes a simple method for the electrolytic polishing of relatively large areas of silver without preliminary grinding.

Chromate Passivation of Sprayed Zinc Coatings. E. E. Halls. Metal Treatment **14,** 164–168 (Autumn 1947).
Describes corrosion tests on sprayed zinc coatings on steel with particular reference to use of sulfuric acid-sodium dichromate solution.

The State of Active and Passive Surfaces Created by Electropolishing Aluminum, Zinc and Iron. Pierre Morize. Metaux & Corrosion **22,** 71–80, 101–108 (1947).
Discusses in detail the oxidation of the surfaces of metals, particularly aluminum, zinc, and iron. Both mechanically and electrolytically polished surfaces were studied with particular emphasis on the latter. The relation between solution potential and crystal structure was studied. Final installment covers oxidation of zinc at room temperature based on solution potentials. Difference between solution potential of cold worked and annealed metal is shown. 43 ref.

Some Special Applications of the Electrolytic Polishing of Metals. H. C. J. de Decker, A. P. Krijff, and J. M. Pluut. Sheet Metal Ind. **24,** 2235–2242 (1947).
Three Dutch research men describe electrolytic polishing methods for carbon steels, zinc alloys and lead alloys. While the object was primarily to facilitate the metallographic examination of these materials, considerable light was thrown on the nature of the distortion in the surface layers caused by mechanical polishing. Contains 15 photomicrographs.

Electroplating on Aluminum—Preparation by Zinc Immersion Process. Myron B. Diggin. Metal Finishing **45,** 67–69. (November 1947).
Gives recipes for surface preparation of the different types of alloys and for plating with copper, nickel, cadmium, zinc, brass, silver, and chromium.

Alloys by Electrodeposition. J. B. Mohler and H. J. Sedusky. Metal Finishing **45,** 65–70 (December 1947).
Discusses practical points which must be considered in development of new plating baths for deposition of alloys. Gives properties of some well-known electrodeposited alloys and discusses future prospects. 20 ref.

The Structure of Hard Chromium Deposits on Steel. H. J. Goldschmidt. Metallurgia **36,** 297–302 (October 1947).
Gives results of investigation by X-ray analysis. Structural conditions associated with high quality were determined. It was found that the base metal plays a vital part and that the structure of the interface between it and the deposit largely decides the properties of the plate. Structural changes on annealing at temperatures up to 1,000° C are followed in some detail, and three classes of occluded hydrogen are distinguished, according to the firmness of binding in the lattice. The effect of external friction on the plating structure is found to be essentially different in the poor and good quality types. A number of subsidiary phenomena are observed and discussed. 17 ref.

True Physical-Chemical Properties of Metal Surfaces as Shown by Electropolishing. P. Lacombe, P. Morize, and G. Chaudron. Rev. Metallurgie **44,** 87–90 (March-April 1947).
Cases where electropolishing does not impart passivity to metals are discussed. Reasons for passivity are investigated and a systematic study of the dissolution potential of electropolishing bath is presented. The presence or absence of oxide surface layers is emphasized. 10 ref.

The Influence of the Basis Metal in Electroplating. R. Piontelli. Sheet Metal Ind. **24,** 2399–2404, 2416 (December 1947).
Experiments on the deposition of lead on various cathodes showed that for a given current density the number of "centers of crystallization" varied considerably with the nature and surface condition of the base metal. The importance of surface irregularities in creating local conditions favorable to the formation of nuclei was shown by the fact that the number of centers of crystallization on copper mechanically polished with fine emery paper was considerably greater than in the case of copper pickled in nitric acid. Possible mechanisms of electrodeposition in the light of fundamental lattice considerations are also discussed. 18 ref.

Spot Test for the Detection of Cadmium in Plating on Metals. Karl A. Jorczak. Chemist-Analyst **36,** 64 (November 1947).
Consists of cleaning with 20 per cent hydrochloric acid and adding a crystal of sodium sulfide. In presence of cadmium a yellow residue of cadmium sulfide is formed.

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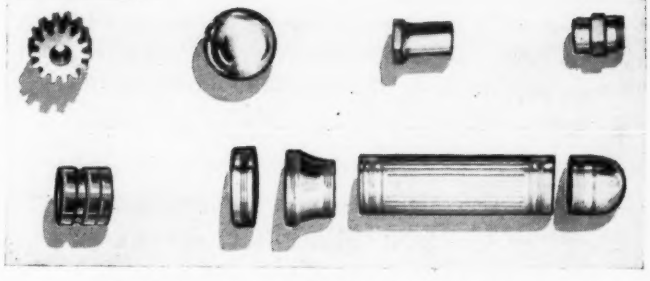

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Bright Hard Nickel Plating of Gages. I. Ya. Kozlov. Stanki i Instrument **17**, No. 1, 23–25 (1946); Translation No. 1926 by Henry Brutcher, Altadena, Calif. 10 pp.
Gives advantages of nickel plating over chromium plating for the above and information on composition of the plating solution and on other operating conditions. Compares the performance of nickel plated and carburized gages. Provides data on solutions used for stripping and dissolving and details on the electropolishing of nickel plated gages.

Increase of Tool Life by Electropolishing plus Chromium Plating. G. Ye. Pochtar' and A. M. Gur'ev. Stanki i Instrument **18**, no. 3, 27 (1947); Translation No. 1993 by Henry Brutcher, Altadena, Calif. 40 pp.
Recommends chromium plating preceded by electropolishing for high-speed tools containing 4 to 9.5 per cent tungsten to increase tool life 50 to 150 per cent. Gives data on best electropolishing and plating conditions.

A Semi-Quantitative Method for Measuring the Ductility of Chromium Electrodeposits. M. R. J. Wyllie. Electrochemical Society Reprint **92-5** (1947), 17 pp.
The Dubpernell test was adapted for assessing quantitatively both initial porosity and cracking of the above deposits after elongation. It is shown that, under the conditions used, porosity always takes the form of small circular holes in the deposits. Relationships of porosity and cracking and the effect of electroplating bath temperatures and other factors on these phenomena were determined.

Practical Facts About Polishing and Buffing Compounds. Part 2. Howard J. McAleer. Die Castings **5**, 62, 64, 66. (December 1947).
Describes what is accomplished by buffing and polishing, the types of compounds employed, abrasives and binders, and methods of spraygun application.

Abrasive Tumbling Reduces Finishing Cost. Vallory H. Laughner. Machinery (American) **54**, 139–146 (December 1947).
Illustrates new applications of above for deburring, cleaning, and finishing operations in both job shops and high-production plants. Includes cost data.

Testing of Alkaline Metal Cleaners. A. Mankowich. Metal Finishing **45**, 77–78, 88 (December 1947).
Various methods are described, and the limitations and advantages of each are discussed.

Secondary Reactions in Phosphating Baths. E. Jaudon. Compt. rend. **218**, 915–917 (1944); Translation No. 2009 by Henry Brutcher, Altadena, Calif. 4 pp.
Describes speeding up of the phosphating reaction by small additions of copper salts. Gives effect of additions of various ions such as chlorate or nitrate and influence of pH of the bath. Discusses mechanism of oxidation of ferrous ion and effect of bubbling air through the bath.

Copper Plating: Cyanide-Free Electrolyte for Coppering Steel. A. Levin. Pract. Chem. (U.S.S.R.) **14**, No. 1, 74–78 (1941); Electroplating **1**, 25–27 (November 1947).
Presents some results of a laboratory investigation of copper sulfate-oxalate baths with and without organic addition agents. Alkaline copper sulfate-ammonium oxalate electrolytes appear to possess some interesting possibilities.

Carbonate Anodizing of Aluminum Alloys. I. Anodization of Duraluminum Under Variable Electrical Operating Conditions of the Bath. A. F. Bogoiavlenskii. Applied Chem. (U. S. S. R.) **20**, 532–538 (June 1947).
Shows that by anodizing duraluminum in carbonate baths, it is possible to obtain corrosion-resistant films. The film obtained with direct current is characterized by maximum compactness. 12 ref.

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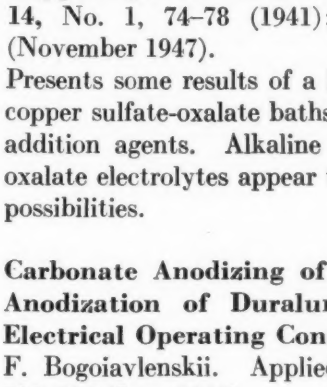
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Smoothing Action as a Mechanism in Bright Nickel Plating. G. E. Gardam. Electrodepositors' Tech. Soc. **22,** 155-168 (1947).

Electrodeposits of nickel from solutions containing zinc, cadmium, or iron, made on a serrated cathode, were shown to be thicker in the hollows than on the crests. Nickel plating solutions which yield bright deposits have been shown by reflectivity tests of deposits on slightly matt surfaces to produce a similar smoothing action, but on a smaller scale. Theoretical and practical importance of this phenomenon is discussed.

I. Standard Threshold Tests. II. Program for Establishing the "Bent Cathode Test" as a Means of Determining Impurities in Nickel Plating Baths. William L. Grube. U. S. Atomic Energy Commission, Oak Ridge, Tenn. Report MDDC-1118 (September 29, 1944). 24 pp.

In evaluation of electrolytes for a specific requirement, it is desirable to determine whether the solution exhibits selective attack on either nickel or copper. An electrolyte which dissolves either of the metals and leaves the other comparatively unattacked possesses the desired properties. Describes a test devised to furnish this information and gives results obtained from its application to several electrolytes. Rate of solution in all cases is too slow for their use in stripping. Also includes a tentative program for the development of a standard "Bent Cathode Test" for the control of impurities in electrolysis for plating nickel.

Dry Friction of Metals as Affected by Surface Finish and Surface Coatings. N. Ludwig. Die Technik **2,** 166–170 (April, 1947); Engrs. Digest (Am. Ed.) **4,** 516–517 (November 1947).

Describes apparatus developed for measuring sliding frictional resistance by use of a test cube pressed against a plane surface. Effect of surface finish was determined for four metals or alloys and for four grades of mechanical smoothness: rough machined, fine machined, ground, and polished. The frictional resistance of ten different surface coatings of either phosphated or plated types was also determined.

Plating Bath Voltage. G. W. Croninger and J. B. Mohler. Iron Age **160,** 66–68 (October 30, 1947).

Resistivity data for a number of common plating baths and an explanation of the use of these data for calculating plating-bath voltage, particularly useful when using high-current-density baths, are given. Such data also indicate changes in conditions that will reduce the required voltage.

Chemical Treatments for Zinc Surfaces—A Review. H. A. Holden. Sheet Metal Ind. **24,** 1975–1983 (October 1947).

67 references.

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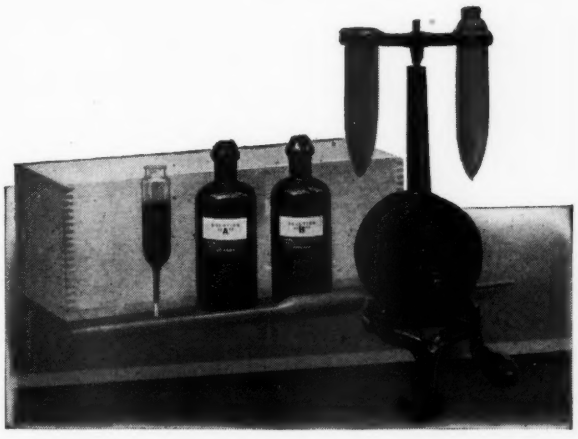

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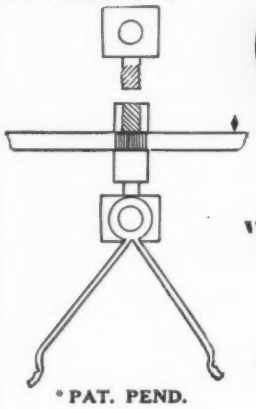

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Patents

By GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

No. 2,438,885, April 6, 1948—Apparatus for Electroplating Rings and Discs—Henderson M. Bell, III, assignor to Chromium Corporation of America.

CLAIM. An apparatus for plating annular articles which comprises in combination a plating tank holding an electrolytic plating bath, open bearings mounted on top of opposite walls of said tank, a work-holding cathode shaft journaled in said bearings, means for rotating said shaft, said bearings and said rotating means permitting the lifting of the shaft and the work bodily out of said bearings and said tank, a plurality of work-holding hubs having elongated sleeve portions adapted to be slipped on said shaft in abutting relationship in such manner that the length of the sleeve portions determines the spacing of said articles and the shaft is protected from the plating bath, three annularly spaced spokes mounted on and radiating from each of said hubs, two of said spokes being of fixed and equal length while the third is adjustable in length, said spokes having outer ends adapted to engage the inner rims of said annular articles in order to support and hold said articles concentrically and in predetermined positions about said hubs, a plurality of anodes mounted in the tank in between and in spaced relationship with said articles, a shoulder on said shaft forming a stop against which said hubs are abutted to determine their spacing from said anodes, and means for supplying plating current to said shaft and said anodes.

1 claim, 10 figures.

References cited: U. S. Patents 526,482; 541,986; 611,418; 637,585; 1,262,248; 1,555,840; 1,991,678; 2,349,908. Brit. Patents 412,685; 442,913.

No. 2,438,897, April 6, 1948—Method of Plating Contact Surfaces of Magnetic Reeds—John T. L. Brown, assignor to Bell Telephone Laboratories, Inc.

CLAIM. In the manufacture of electric apparatus consisting of glass sealed magnetic reed contact elements, the step of plating the contact surfaces of the reeds with a noble metal by placing each of a plurality of said reeds in an individual cathode circuit ncluding an individual fixed resistance of approximately 100 ohms and completing said circuits in parallel through a noble metal plating electrolyte to a common anode to render the current in each said individual cathode circuit substantially uniform and equal to the current in each other of said parallel circuits regardless of variations in the individual resistances of the reeds.

1 claim, 16 figures.

References cited: U. S. Patents 602,212; 645,786; 874,374; 887,539; 891,361; 2,044,415; 2,044,431; 2,149,-

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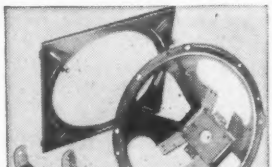

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344; 2,236,647; 2,249,765; 1,527,095; 2,289,330; 1,727,736; 542,986. German Patent 451,623. Austrian Patent 88,462.

"Electrodeposition of Metals" by Langbein (1924), pp. 162–164, 205, 206–207. The Petroleum Engineer, 156–157 (October, 1940).

No. 2,439,190, April 6, 1948—Electroplating Rack—Leroy E. Schroeder, assignor to Western Electric Company.

CLAIM 2. An article-supporting rack for electroplating comprising an insulation-coated frame of electrically conducting material, a cross bar on said frame also coated with insulation and having a screw-threaded cavity therein terminating in a cone-shaped inner wall, an article-supporting and electrically conducting hook having a threaded portion threaded into said cavity, and a deformable metallic contact pellet interposed between the cone-shaped inner wall and an end of the conducting hook and compressed to provide an appreciable area of contact between the cross bar and hook for insuring a positive electrical contact therebetween, said portion of the hook having a coating of relatively fluid insulation thereon which is partially removed by the abrasive action of threading the hook into the cross bar to deform the deformable contact pellet.

2 claims, 2 figures.

References cited: U. S. Patents 731,453; 799,861; 1,281,983; 1,895,845; 2,177,453; 2,275,382. British Patents 14,133; 288,813; 362,756. French Patent 690, 318.

Alien Property Custodian Publication No. 290,026, July 13, 1943.

No. 2,439,491, April 13, 1948—Enclosed Electroplating Tank—Charles Schiffi, Montclair, N. J.

CLAIM 3. An electrolytic apparatus comprising a container for electrolyte having an open top and wherein relatively warm moisture and gases are formed during operation of the apparatus, a casing completely enclosing said container with spaces between said container and said casing, said casing having a top wall provided with an opening above said container for access to the latter, a removable cover for said opening having top, side and end walls and a partition beneath said top wall of the cover formed with portions extending inwardly from the side walls that converge downwardly toward and meet above the open top of the container so that moisture rising from the electrolyte in said container will impinge on said converging portions, perforations in said converging portions closely adjacent the meeting line of said portions and perforations in said side walls of said cover above said partition and means for drawing air through said perforations and transversely of the open top of said container above said electrolyte and downwardly through the spaces between said container and said casing and out of the casing, whereby said converging portions will be cooled so that some of the moisture rising from said electrolyte will condense on

said portions and drip into the container while at the same time some of the gases that rise from the electrolyte will be withdrawn.

3 claims, 8 figures.

References cited: U. S. Patents 692,597; 1,008,383; 1,057,788; 1,144,271; 1,243,384; 1,344,030; 1,435,671; 1,444,787; 1,545,352; 1,664,482; 1,723,480; 1,857,903; 1,917,657; 2,110,991; 2,111,377. German Patent 493,223.

No. 2,439,858, April 20, 1948—Conductor Roll—Earil R. Muddiman and William E. Winterhalter, assignors to Carnegie-Illinois Steel Corporation.

The present invention provides a conductor roll for use in conjunction with electrolytic processes, which roll is resistant to chemical attack by the electrolyte used in such processes, whether they be cleaning processes, where a metallic body such as a metal strip is conveyed through the electrolyte by the roll, in which electrolyte the strip is subjected to a cleaning operation such as, for example, anodic cleaning, or where the strip is being conveyed through the electrolyte as a cathode for receiving a deposit of metal electrolytically thrown out of solution by the action of a metal-depositing current.

CLAIM 4. Apparatus for electroplating metal on a continuously rapidly moving strip of dissimilar metal which comprises a combined conveyor and conductor roll for conveying the strip through an electroplating bath, the said roll also contacting the strip and supplying electric current to the strip as it moves through the plating bath and making the strip cathode in the bath, the said combined conveyor and conductor roll comprising a hollow cylindrical roll body composed of high conductivity metal, a facing on the roll body adapted to contact the strip and having a hardness substantially greater than the strip and the metal being plated onto the strip, a shaft for mounting the roll body, the said shaft being composed of high conductivity metal, means for conducting current to the shaft, spaced conductive diaphraghm means mounted on the shaft in the roll body dividing the said roll body interiorly into a series of transverse cooling compartments, the said diaphragm means having a diameter equal to the interior diameter of the roll body and circumferentially engaging the roll body and welded to the shaft and to the roll body in intimate electrical connection with both the shaft and the roll body, the said diaphragm means constituting the major conductive path for major portions of current between the shaft and the roll body, electrically conductive and closure members for the roll body closely engaging the shaft and roll body, the said end closure members being less conductive than the diaphragm means but cooperating with the diaphragm means to assure uniform distribution of current on the entire roll body, and means for maintaining each of the cooling compartments in the roll body continuously filled with continuously circulating cooling fluid.

10 claims, 7 figures.

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References cited: U. S. Patents 706,550; 1,233,906; 1,358,205; 1,704,129; 1,724,676; 1,805,549; 1,952,762; 2,035,312; 2,035,517; 2,803,253; 2,266,347; 2,341,157. British Patents 12,717; 513,220.

No. 2,439,935, April 20, 1948—Indium Electroplating —Thomas R. Jones and Nevin R. Bierly, assignors to The American Metal Company, Limited, New York, N. Y.

Several processes have heretofore been proposed for electrolytic deposition of indium, but so far as we are aware, these processes are troublesome to operate because they require frequent adjustment of chemicals in the solutions to keep them up to strength ..... the electrolytes must be reworked and purified or replaced with fresh solutions.

The principal object of our invention, accordingly, is to provide a simple, efficient process which shall avoid some of the difficulties mentioned.

EXAMPLE 1. Fifty-five grams of cupric oxide (CuO) was dissolved in a solution containing 160 grams per litre of perchloric acid ($HClO_4$), 100 per cent. The dissolving of the CuO was speeded up by heating; however, the solution was not heated to the boiling point. As soon as the CuO was all in solution, a calculated quantity of pure indium was submerged in the $Cu(ClO_4)_2$ solution and $In(ClO_4)_3$ was formed by cementing out the copper. Upon completion of the reaction, when no trace of copper remained in the solution, the cement copper was filtered off, leaving a water-white solution of indium perchlorate.

This solution, prepared as above, was placed in a glass tank and a pure indium metal slab suspended as an anode. The following metals, employed as cathodes, were plated in this solution: Copper, brass, aluminum, silver, lead, steel and cadmium, of which copper, silver, lead and cadmium are well-known components of bearings. The same conditions were maintained in each case . . current density, 30 asf; temperature 78° to 80° F; voltage 1.15 volts. The plating time was 30 minutes for each metal and fine grained smooth deposits were made in each case.

CLAIM 6. A process for electrodepositing indium which comprises electrolyzing an aqueous solution of perchloric acid with electrodes including a substantially pure indium anode until an electrolyte consisting of indium perchlorate in water with some free acid is formed, adjusting the indium content thereof to about 20 to about 60 grams per liter and the free perchloric acid content to about 1 to about 75 grams per liter, employing a substantially pure indium metal as an anode and a bearing as the cathode in said electrolyte, and electrodepositing indium on the bearing surface of said bearing, adjusting the current density to about 10 to about 55 amperes per square foot, the voltage to about 0.6 to about 2.5, and the temperature of the electrolyte to about 75° F to about 130° F.

6 claims, 3 examples.

References cited: Trans. Electrochem. Soc. **26**, 135 (1914); **79**, 443–450 (1941).

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E—97. Emulsifiable Solvent Cleaner—A new emulsifiable solvent cleaner that dilutes with water for efficient cleaning of metal parts in pressure spray-type washing machines, has recently been announced by Oakite Products, Inc., 140 Thames Street, New York 6, N. Y. Designed to solve difficult problems of large-scale production cleaning, Oakite Composition No. 97 forms water emulsions suitable for spray application in single or multi-stage metal washing machines for cleaning steel, brass, aluminum, zinc and other metals before electrocleaning, as a prepaint treatment, or for use between processing operations. Extensive shop and factory tests on sheet metal and die castings have demonstrated, it is said, its ability to remove buffing compounds, drawing and stamping compounds, cutting and grinding compounds, mill and slushing oils, other rust-preventives, cutting and machining oils, metal chips and shop dirt. Paramount among the reported features are (1) its surface-active agents speedily penetrate and loosen deposits so that they really flush away under the impact of cleaning and rinsing sprays, (2) at recommended concentrations it shows no tendency to foam, (3) since the emulsions do not hold soils in permanent suspension, their effective life is prolonged and nozzle-clogging reduced, (4) a temporary rust-retarding film remains on the work, (5) added to rinse water in small quantities, it minimizes water-spotting, (6) the water emulsions present no fire hazards and do not give off toxic vapors.

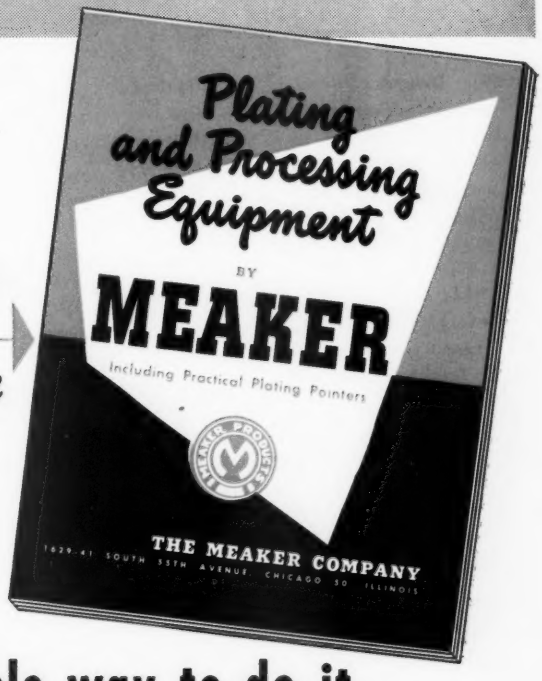
Oakite Composition No. 97, the manufacturers state, has proved highly effective in machine-cleaning such a variety of work as: auto frames, bolts and other threaded parts, brake drum parts, cylinder heads and liners, gears, handles, hand rests, hinges, heater shells, kitchen cabinets, machined castings and screen and window frames. For additional information, use Reader Service Card.

E—98. Plating Tanks of Hi-Temperature Lucite—Elimination of the final obstacle preventing the use of H-T Lucite for plating tanks has been achieved by means of the Singleton-Weld, a pure weld of the material, according to the Singleton Company, 9823 Lorain Avenue, Cleveland, Ohio.

Principal advantages claimed are resistance to all acids and alkalies; absence of contaminating effects and leaks; permanance; transparency—11 per cent clearer than glass (for watching baths in

New a complete booklet!

ELECTROPLATING MACHINES
"Tailored to Fit"
PRACTICAL PLATING POINTERS
Plating Data Tables



Write for Your Copy

the profitable way to do it

Making every operation in a plating sequence as automatic or as mechanized as possible is the profitable way. This new booklet illustrates and describes a variety of ways it is done with Meaker Machines Not only is the cost lower, but the production is increased, and a better and more uniform quality of product is assured.

You should get a copy of this booklet for ideas on improving your plating processes. The Practical Plating Pointers including several new tables are a convenience for those in charge of plating departments.

THE MEAKER COMPANY
1629-41 South 55th Ave., Chicago 50, Illinois

Full Automatic and Semi-Automatic Electroplating Equipment • Strip Steel Plating Equipment • Wire Galvanizing Equipment • Strip Steel Electrocleaning Lines • Pickling Machines • Processing Conveyors Motor Generators for Plating • Rectifiers for Plating

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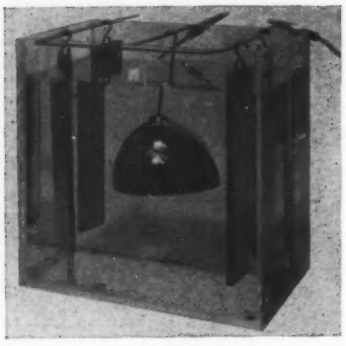
Equipment & Supplies



action); high tensile and impact strength, and machinability. For further information, use Reader Service Card.

E—99. Bright Barrel Zinc Plating Process—Flashing bright, right from the plating barrel, comes zinc plated work processed by the BB2-200 process, according to the supplier, Hanson-Van Winkle-Munning Company, Matawan, N. J. It is also said to stay bright longer. Developed expressly for barrel zinc plating only, this process is said to produce its characteristic brilliant deposits over a wide range of current densities. Subsequent bright dipping is not necessary. Low concentration in the bath and low consumption add economy. For further information, use Reader Service Card.

E—100. New Fume Separator—A new Niehaus Fume Separator, incorporating three recent modifications, was shown by the Industrial Electroplating Company, Inc. of Indianapolis at the American Electroplaters' Society Industrial Finishing Exposition in Atlantic City, June 28–July 1.

Inventors of the fume separator, which functions through the principles of water absorption and centrifugal separation, are William and Carl Niehaus, youthful brothers, who own and operate an Indianapolis plating plant. They were encouraged to enter the manufacturing field by the interest shown in an experimental model at the 1947 Convention of the A. E. S. Within their first year, 11 distributors have been appointed to handle the Niehaus Fume Separator and multiple units have been installed in more than 50 factories and plating shops. The Niehaus brothers now are working to perfect test models of a second invention—a dust collector. For further information, use Reader Service Card.

E—101. Rack Coating—A new improved single-dip heat-cured rack coating material to be known as Miccrosol E-1003 has been introduced by Michigan Chrome and Chemical Company, 6351 E. Jefferson Avenue, Detroit 7, Mich. This 100 per cent solids material produces a tough, smooth, leather-like coating. A series of tests on tensile strength, adhesion, hardness, tear strength, elongation, and recovery show a marked superiority over other well-known rack coatings. It is claimed to combine, in addition to positive insulation and protection: permanent flexibility, positive and continuous adhesion, high scuff resistance, simplicity of application, savings in time, labor and material, and to withstand all commonly used plating solutions, acids, and caustics.

Only one coat is required over the primer. Racks are completely processed, ready for use, in approximately two to four hours. For further information, use Reader Service Card.

E—102. Metal Masking Templates—The difficult and costly procedure of forming masks by hand and the necessity of cleaning after painting are said to have been eliminated in the new form-fitting electro-formed metal masking templates, manufactured by Conforming Matrix Corporation, 340 Toledo Factories Building, Toledo 2, Ohio. They neither deteriorate nor lose their form during cleaning. Bright, durable enamels, one color right after another, can frequently be wet painted before baking on many convex, concave or irregularly shaped three-dimensional parts with these masks. Clean-cut, sharply defined letters and effects on even small emblems of intricate design are obtained. Emblems of intricate design, nameplates, hubcaps, horn buttons, dials and utility markings for household appliances can now be made rapidly, easily and economically by all manufacturers through the use of these new masks.

There are three general classifications of form-fitting masks: the lip type, the plug type, and the block cut-out plane surface mask. By means of special arched bridging, the "loose" inside of letters and numerals, such as "O" and "6", are held in position, to effect perfect characters without the use of the objectionable "ties" used with common stencils. Plug masks must always be used on plastics where side lighting is employed to illuminate clear depressed characters such as speedometer and radio dials. Plug masks are also applicable to plastics molded in solid color but to be decored with additional colors on the face surface. A majority of parts can be painted by laying them on a turntable and placing the mask on them. Frequently the mask is mounted rigidly in the booth and the piece brought to the mask. Where parts have a tendency to warp or their light weight and size allows distortion from polishing, clamping fixtures are suggested for best results. Masks are also designed for attaching to parts moving on a monorail or merry-go-round, for either manual or fully automatic spraying. For further information use Reader Service Card.

E—103. Buffer and Polisher for Vari-Shaped Objects—Type V-1 semi-automatic Buffing and Polishing Machine manufactured by Vanott Machine Corporation, 248 Colgate Avenue, Buffalo 20, N. Y., and geared to handle articles of nearly every shape and size, is said to offer a means of obtaining uniformly high quality finish while reducing labor costs. It is adaptable to many different shapes because it is fully adjustable for heights, angle, spindle speed, and stroke (up to 6 inches).

The chucks, or holding devices, are individually designed to hold the item being buffed or polished. All vital mechanism is enclosed to give protection from abrasive wear, and a foot pedal revolves the head, allowing the operator the use of both hands for changing parts. A ½-hp motor provides ample power, and it can be plugged into any light socket. For further information, use Reader Service Card.

E—104. New Corrosion-Resistant Air-Drying Coating—Easier application, without primer, increased corrosion-resistance and durability are among the factors that feature a new product, LC-600, of Lithgow Corporation, 333 W. 40th Place, Chicago 9, Ill. It is for use in tanks, driers, pipe fittings, filter bodies, and scores of other uses in chemical industries.

LC-600 embodies important properties based on inert synthetic resins. It may be sprayed, dipped, flowed, roller coated, or brushed on almost any clean unpolished, de-rusted surface.

It is positively resistant to acids, alkalies, chlorides, oils, salts, oxygen and alcohol solutions. Electrochemical corrosion is said to be prevented by its high dielectric strength. It contains no vegetable oils causing oxidation or deterioration with age and is odorless and tasteless. The new product is said to have been well proved in use as well as in severe laboratory tests. For further information, use Reader Service Card.

E—105. Stop-Off Coating for Selective Tin Plating—A formulation of colloidal graphite in resin-naphtha has been developed by Acheson Colloids Corporation, Port Huron, Mich., for use as a stop-off coating for selective tin plating. It is easily applied to that portion of a surface on which it is desirable or necessary to prevent adhesion of the tin. The coating readily withstands a muriatic acid pickling bath used in tin plating operations as well as the fluxing dip and molten tin dip. For further information, use Reader Service Card.

E—106. Amine Bright Copper Process—Speed and brightness of deposit are

(*Continued on page 774*)

DULUTH DURO-FLOW Bias Buffs

Yes suh! What a face on that Duro-Flow Bias Buff. . . . it's one bias buff that can't be beat for full coverage of the finishing surface, especially on flat work. You see all that shirring! . . . that's so the work won't ridge. These Duro-Flows are air-cooled, too! They're cut on a bias so they're anti-raveling.

In fact, they're about everything you could want in an all-around quality buff that does a swell job of coloring as well as cutting down. Talk about wear! —every finisher that uses Duro-Flow Bias Buffs wears a smile. . . . what a smile. . . . what a face. . . . what a buff!

Just write Duluth Buff Company, Chicago 16, Illinois. You'll See What We Mean.

DULUTH BUFF COMPANY

CHICAGO 16, ILLINOIS

New Literature

L–74. Unusual Chemicals—Many rare metals and their salts as well as unusual inorganic and organic chemicals are listed as available in Bulletins Nos. 70 and 71 published by A. D. MacKay, 198 Broadway, New York 7, N. Y.

L—75. Ball Burnishing Steel, Brass and Aluminum—Interesting data on the factors to be considered in making a proper choice of a lubricant for use in ball-burnishing operations and specific recommendations for preparatory cleaning and rinsing procedures are contained in a special service report, "Oakite Composition No. 3 and Its Uses for Improved Ball Burnishing", just published by Oakite Products, Inc., New York 6, N. Y.

The ideal lubricant, the report states, is one with free-rinsing and high lubricating action, free from ingredients which might attack the metals being burnished, able to suspend the finely divided material released during the burnishing operations, and adaptable for use in either hard or soft water. Oakite Composition No. 3 is said to provide the following advantages: (1) it can be added directly to the barrel in dry form, (2) has high resistance to acids carried over from rinses after bright dips, (3) may be used in either hard or soft water, (4) possesses effective lubricating properties, preventing metal-to-metal scratching, (5) produces ample, thick suds, (6) rinses freely and keeps dirt in suspension during burnishing, (7) puts unfinished surfaces in receptive condition for subsequent plating, (8) improves luster of plated work, and (9) retains lubricating properties longer so that less material is needed for upkeep.

The service report further stresses the importance of thorough cleaning and rinsing before burnishing, and describes specific procedures for pre-cleaning steel, brass and aluminum. For your copy, use Reader Service Card.

L—76. Tumbling Abrasives—An 18-page bulletin on "Precision Tumbling with Aluminum Abrasive" discusses this subject in a lucid manner, placing emphasis on tumbling with specially prepared abrasives manufactured by Norton Company, 1 New Bond Street, Worcester 6, Mass., as a substitute operation for surface finishing various parts (gears, castings, threaded parts) on bench grinders or with small portable grinders. For your copy, use Reader Service Card.

L—77. Safety Apparel—A new 4-page release by Industrial Products Company, 2920 N. 4th Street, Philadelphia 33, Pa., on safety apparel such as synthetic gloves, coated gloves, gum gloves, white chemist aprons, Neoprene aprons, cushion knee pads, sleeve and two-piece rubber suits includes description and prices. For your copy, use Reader Service Card.

L—78. Conversion Coating for Zinc and Cadmium—A 4-page folder on "Unichrome Clear Dip" issued by United Chromium, Incorporated, 51 E. 42nd Street, New York 17, N. Y., describes an improved chemical treatment for producing a brilliant, corrosion-resistant finish on ordinary zinc or cadmium plate. It shows the simple operating cycle of this dipping process, illustrates how it benefits zinc or cadmium, and gives general specifications on use. For your copy, use Reader Service Card.

L—79. Bright Nickel Process—The McGean Chemical Company, Cleveland 15, Ohio, has published an 8-page bulletin which describes its bright nickel process and supplies and customer service policy. For your copy, use Reader Service Card.

L—80. Belt Finishing Equipment—Behr-Manning, Troy, N. Y., has issued a new 6-page bulletin, "Belt Grinding and Finishing with Idler Backstands", describing the process, the contact wheels and cement, applications to contour polishing, and various sizes of backstands. For your copy, use Reader Service Card.

L—81. Bright Alloy Process—An 8-page Technical Instruction Bulletin issued by Hanson-Van Winkle-Munning Company, Matawan, N. J., on its Albaloy Process presents sections on solution preparation and control, notes on operating techniques, equipment required, and a dropping test set for thickness of the deposit. For your copy, use Reader Service Card.

L—82. Rod Agitators—A 4-page Bulletin 199 issued by the Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago 51, Ill., describes in detail Belke's Standard and Streamlined Rod Agitators and accessories and gives specifications and mounting details for fastening the units to tanks. For your copy, use Reader Service Card.

L—83. Corrosion-Resistant Plating Equipment—Classifying stainless steel, nickel, Monel and Inconel as semi-precious metals, Storts Welding Company, Incorporated, Meriden, Conn., has issued an illustrated bulletin featuring various types of plant equipment of special design fabricated in these metals. The fabrications shown include plating and rinsing tanks, processing tanks, annealing hoods, trays and baskets, piping and duct work, and material handling equipment—all for service where corrosion resistance, heat resistance or both are required. The advantages and the fields of application of the semi-precious metals are noted and suggestions are given for supplying information to the fabricator when inviting estimates on special equipment for corrosion and high temperature conditions. For your copy, use Reader Service Card.

L–84. Industrial Chemicals—The Harshaw Chemical 1945 E. 97th Street, Cleveland 6, Ohio, has issued a 32-page booklet which sets forth the history of the company and its major activities. An alphabetical listing of hundreds of chemicals supplied to the trade is given, and mention is made of the full line of laboratory apparatus and chemicals carried in stock. For your copy, use Reader Service Card.

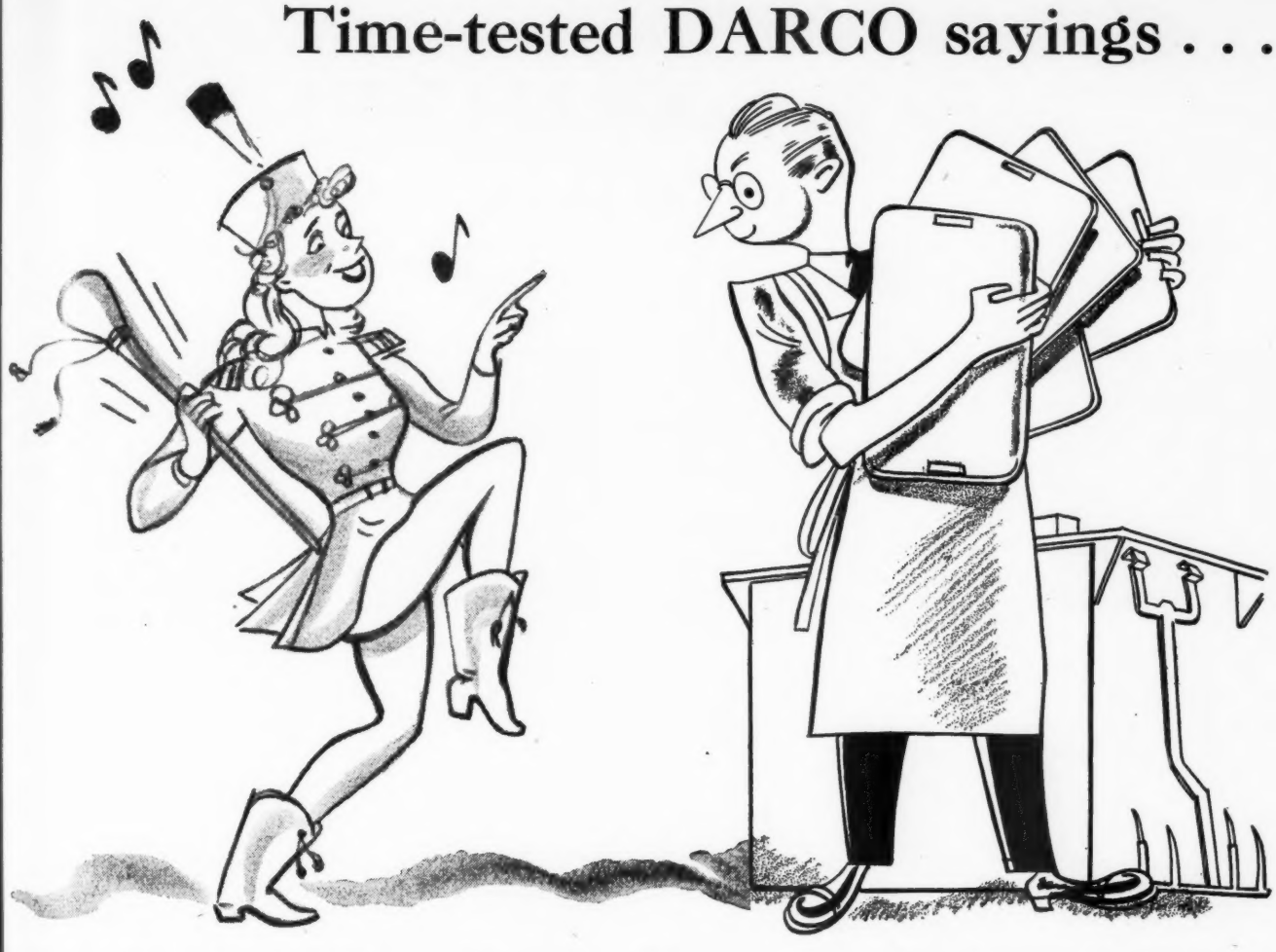
L—85. Grinders and Polishers for Sheet, Strip and Bar—The Hill Acme Company, 6400 Breakwater Avenue, Cleveland 2, Ohio, offers its Bulletin No. GP-1 which describes the above items in detail. For your copy, use Reader Service Card.

L—86. Cleaning and Surface Treatment of Ferrous Metals Before Painting—An easily controlled procedure for cleaning and surface treatment of ferrous metals to provide improved paint adhesion is described in a new 6-page Service Report issued by Oakite Products, Inc., 140 Thames Street, New York 6, N. Y. This Oakite CrysCoat Process, in which a specially formulated acid cleaner is applied to metal surfaces as work is routed through a three or more stage pressure-spray washing machine, performs the following three functions: (1) removes light soils, grease, spinning compounds and shop dirt, (2) improves paint grippage by imparting to surfaces a thin, crystalline phosphate film, and (3) retards rusting of metal surfaces between cleaning and painting operations and localizes corrosion if painted finishes become scratched or marred during use.

The new Service Report features an Application Check Chart offering detailed data on CrysCoating procedures, including recommendations of specific solution concentrations, temperatures, time cycles, and pH range. For your copy, use Reader Service Card.

L—87. Cobalt-Nickel Plating Processes—The Hanson-Van Winkle-Munning Company, Matawan, N. J., offers a 12-page Technical Instruction Bulletin which describes its Type 9H, Type 5 and Type AA Cobalt-Nickel processes, including details concerning the preparation, operation and maintenance of the baths. For your copy, use Reader Service Card.

Time-tested DARCO sayings . . .



It's Easier To Keep Your Solutions Clean than To Take Losses for Spoiled Work

Lead the parade! Use DARCO S-51 as your baton and you'll set the tune for better electroplating!

DARCO takes care of those many impurities that pass through a mechanical filter—by adsorption. You'll simplify your work by letting a little DARCO help keep a lot of solution clean.

DARCO is easily wetted and incorporates readily into the slurry . . . in a word, is easy to handle. DARCO is easy on the cost sheet, too—just a few cents' worth will purify 100 gallons of solution a week. You'll find DARCO ideal, in conjunction with a filter, for purifying plating baths for bright nickel—copper—iron—zinc—cadmium—tin—gold and silver.

DARCO *can* help you improve your work at lower cost—and DARCO technicians are ready to show you how. DARCO distributors are everywhere—write yours for a sample, today.

Is your plating bath as clean as the water used in your final rinse?

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A. E. S. OFFICERS

1948-1949

SAMUEL S. JOHNSTON
President

Born August 10, 1905, in Steubenville, Ohio; graduated from the College of Engineering, Ohio State University in 1932.

Laborer, Carnegie Steel Company; Research worker, U. S. Bureau of Mines; Analytical Chemist to Technical Director, Electrolytic Department, Weirton Steel Company, Weirton, West Virginia.

Past President, Pittsburgh Branch A. E. S.; General Chairman, 33rd Annual Convention, A. E. S.; member, The Electrochemical Society, American Institute Chemical Engineers, American Society for Testing Materials.

ARTHUR W. LOGOZZO
First Vice-President

Formerly Foreman Plater, General Electric Company, Pittsfield, Mass.; Plating Superintendent, Hartford Chrome Corporation, Hartford, Conn.; Service Engineer, MacDermid, Incorporated, Waterbury, Conn.; now President of Nutmeg Chrome Company, Hartford, Conn.

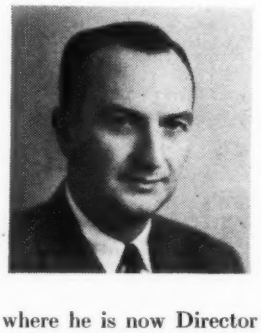
Past President of Hartford Branch, A. E. S.; recipient of First Exhibit Prize at the 1941 Convention for a display of chromium-plated dies and molds. Winner of the Coffin Award, General Electric Company's highest award for contribution to the electrical art, for development of mold-plating methods.

WILLIAM J. NEILL
Second Vice-President

Born on July 1, 1901, and attended school in a great many cities due to his father's business. Franklin University is his alma mater.

General Superintendent of Columbus Metal Products Company, manufacturers of oil burner and truck and bus equipment.

Past President (two terms) of the Dayton Branch; instrumental in organizing the Columbus Branch. Member of American Institute of Chemists and Vice-Chairman of its Miami Valley Chapter; member of the Board of Governors of the Ohio Committee for Professional Practice; member and Post Officer of Kiwanis International.



C. F. NIXON
Third Vice-President

Born in Philadelphia, Pa., on May 4, 1901; graduated from the University of Wisconsin in 1923 with a B.S. in Chemical Engineering.

Employed in the laboratory of Western Electric Clock Company, Peru, Ill., for six years; since then with Fisher Body-Ternstedt Division of General Motors Corporation, where he is now Director of Process Engineering.

Member of the American Electroplaters' Society since 1924; now President of Detroit Branch. Contributed many papers on electroplating subjects and received several awards.

A. KENNETH GRAHAM
Executive Secretary

Born December 25, 1896, Philadelphia, Pa.; attended University of Pennsylvania and Columbia University; holds B.S., M.S., and Ph.D. from University of Pennsylvania.

Research work, Scoville Manufacturing Company, Waterbury, Conn., 1919–1920; Instructor in Chemistry, University of Pennsylvania, 1921–1926; Chemical Engineer, H-VW-M Company, 1926–1928; Instructor and Assistant Professor in Chemical Engineering, University of Pennsylvania, 1928–1937; Consultant, A. K. Graham & Associates, 1936–1942; Consultant and Deputy Chief, Products Branch, Conservation Division W. P. B., 1942–1943; Director of Research and Development, Garfield Division, Houdaille-Hershey Corporation, 1943–1944; President, Graham, Crowley & Associates, Inc., 1944 to date.

KENNETH M. HUSTON
Past President

Born in Brazil, Ind.; B.S. in Chemical Engineering from Rose Polytechnic Institute, Terre Haute, Ind., 1920.

Junior Engineer, Empire Gas and Fuel Company; Analytical Chemist and Assistant to Technical Director, Chemical Warfare Service, Edgewood Arsenal; Manufacturing Planning Engineer, Development Engineer and Finishing Engineer, Western Electric Company, Baltimore, Md.; Senior Research Engineer with Rustless Iron and Steel Division, Armco Steel Corporation, since late 1945.

President, Baltimore-Washington Branch, A. E. S., 1944–1946; member of Alpha Chi Sigma and American Legion.

A. E. S. Convention News

The Thirty-fifth Annual Convention of the American Electroplaters' Society, which ended on July 1, was outstanding in the smoothness and dispatch with which every activity was handled. Much of the credit goes to the Newark Branch Committee headed by Mr. John L. De Vries, Convention Co-chairman, and its many sub-committees with their chairmen. It is difficult to single out any one of the functions for special mention; most visible, perhaps, was the excellent timing of the Educational Sessions under Mr. Myron B. Diggin, which started on time, ended on time and still allowed adequate opportunity for discussions; most impressive, the gorgeous entertainment at the Banquet with Mr. Paul A. Oldam the Entertainment Chairman, as a witty Master of Ceremonies.

Industrial Finishing Exposition

While smaller than last year, the Exposition was much appreciated by both general visitors and Convention registrants. The Committee, with Messrs. George Wagner and Howard Cobb as Chairman and Co-Chairman respectively, can look back on a well organized affair.

The Plated Ware Exhibit was again placed with the Industrial Finishing Exposition. Half of the Branches in the United States participated with unusually diversified products illustrating the wide range of plating applications. Both A. E. S. Third Vice-President William J. Neill whose promotional efforts showed such excellent results and Newark Branch Exhibits Chairman Louis J. Donroe whose committee was responsible for the excellent arrangements, should be pleased with the success of their efforts.

Entertainment

The entertainment program began with the Open House sponsored by The International Fellowship Club, Mr. Thomas A. Trumbour, Permanent Secretary. Put on by the supply houses of the industry, this friendly affair, as always, was much appreciated by the Convention visitors. The same may be said of the International Fellowship Club Golf Tournament run by Mr. Joseph J. Duffy, Jr.

The ladies were entertained separately by the Convention Committee at tea, by Oakite Products, Inc., and by the International Fellowship Club.

The weather was all that could be hoped for, and surf and sun bathing was generally practiced, even by the busy Delegates.

Convention Business

A Delegate of 10 or more years ago would hardly recognize the business meetings held during this Convention. The general items of business had been so thoroughly prepared by the Executive Board and Executive Secretary and each proposed action was so well motivated that there was little room for disagreement.

The new *Constitution and By-Laws*, published in the April issue, was adopted unanimously with few changes: half a dozen editorial corrections were made by the Law Committee, and the Boston Branch offered three amendments, which were accepted, restoring certain powers to the Branches but still leaving the Executive Board all required freedom of action. Special acknowledgements should be made of the careful work done by the Constitution Revision Committee, Messrs. A. W. Logozzo, Chairman, F. J. MacStoker, F. R. Keller, C. F. Nixon, and C. Kelly and its Technical Assistant, Mr. Manson Glover, and of the cooperation of the Branch committees especially formed to collect and formulate the Branch's desires.

The proposed *Budget* presented by First Vice-President S. S. Johnston was adopted without discussion. The Society functions call for an expenditure of $35,600.00, and the operation of Plating is estimated to balance at $70,300.00. If one adds to this about $25,000.00 for Research Committee activities, one reaches a total figure of over $130,000.00.

Third Vice-President W. J. Neill on behalf of the Executive Board recommended that the individual Branches give serious consideration to incorporation to protect the Branch members.

New Honorary Members

Mr. Frank C. Rushton, who, after having served St. Louis Branch as Secretary-Treasurer, organized the Los Angeles Branch on February 4, 1929 and since has helped organize the San Francisco, Sydney, Melbourne and Adelaide Branches, was proposed by the Los Angeles Branch through its Delegate, Mr. H. Woodward.

The name of Mr. Andrew W. Garrett was proposed by the Boston Branch through Mr. Manson Glover. Mr. Garrett founded the Boston Branch thirty years ago, and was its Secretary until 1946 when he became its president. He has missed one Branch meeting during all these years.

Both of these men were elected Honorary Members by acclamation and join the illustrious company of fifteen other men whose outstanding services have enhanced the Society's welfare.

Dr. William Blum of the National Bureau of Standards, an Honorary Member of the Society, was elected the first Honorary Member of the Research Committee.

Awards

The *Membership Awards* to the Branches exhibiting the highest percentage gain in membership during 1947-1948 was given to the Pittsburgh, Rochester and Cincinnati Branches, winners in their respective divisions. The awards were beautiful cups donated by W. & S. Blackinton Silver Company, Meriden, Connecticut.

The authors of two of the many excellent papers given at the Convention were presented with the Society's *Paper Awards*. Dr. Abner Brenner and Mr. Seymour Senderoff of the National Bureau of Standards received the Herminie Dorothea Proctor Award of $100.00 for their paper, "The Helical Contractometer, a New Instrument for the Measurement of Stress in Electrodeposits." Messrs. R. H. Cahan and C. E. McKinnon of E. I. duPont de Nemours & Co. were given the Founders Gold Medal for their paper, "Diaphragm Tanks to Eliminate Roughness in Copper Plating."

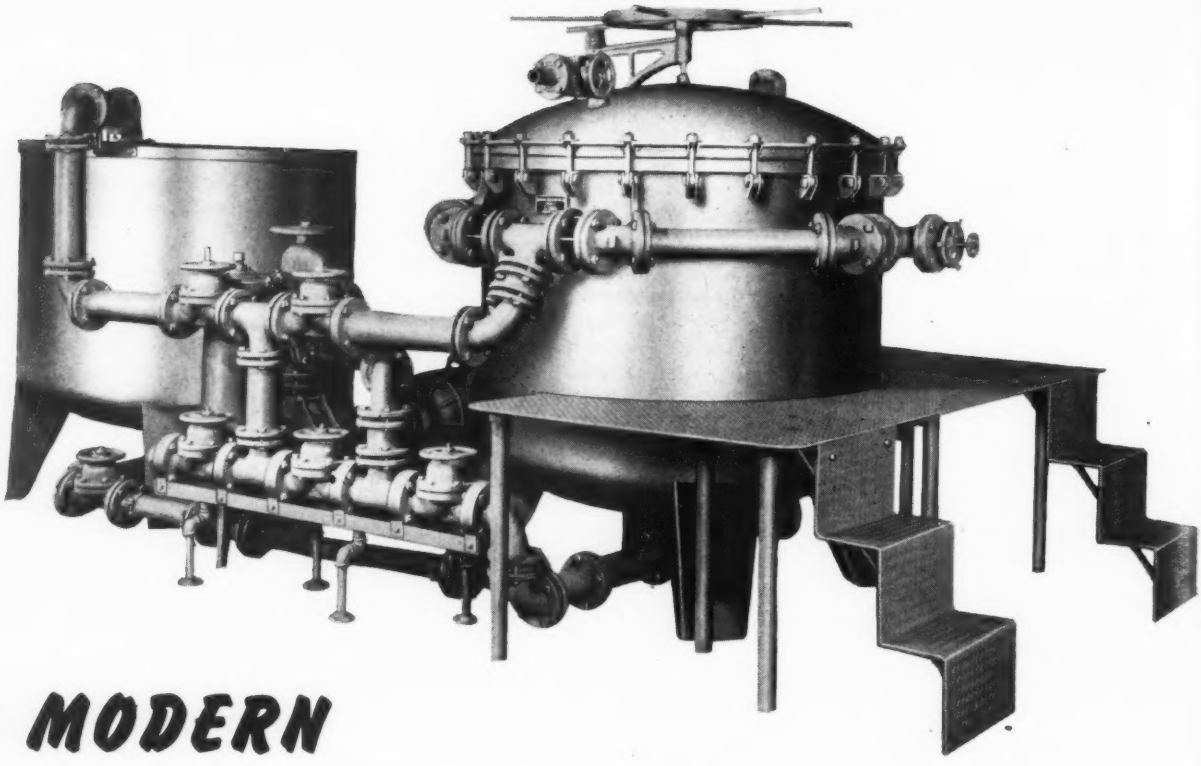
Other awards were given to authors of articles in The Monthly Review and Plating during 1947–1948. The Society's Award of $50.00 went to Mr. C. F. Nixon of Fisher Body-Ternstedt Division, General Motors Corporation, and Dr. R. C. Olsen of Pacific Lutheran College for their article, "Notes on Nickel and Chromium Plating," and the A. E. S. Gold Medal to Mr. E. J. Roehl of Thomas Steel Company for his article, "Mechanical Properties of Nickel Deposits."

Two *new paper awards* were offered for presentation next year. A Mechanical Finishing Award of $100.00 was generously donated by the Lea Manufacturing Company of Waterbury, Connecticut, Mr. R. S. Leather, President, and a Chromium Plating award of $50.00 by Nutmeg Chrome Corporation, Hartford, Connecticut, Mr. A. W. Logozzo, President, for the best papers or articles in the respective fields.

The three *Branch Exhibit Awards* were given to the Columbus, Twin City, and Buffalo Branches. They consisted of $150.00, $75.00, and $50.00 respectively and certificates. An individual award of $50.00 and certificate was given to Mr. Harold Narcus, Electrochemical Industries, Leominster, Massachusetts. These prizes were donated by the Newark Branch.

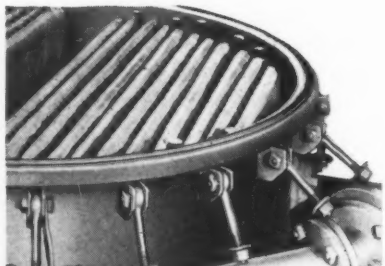
The awards were presented at the Banquet with appropriate ceremonies.

(To be continued)



A MODERN INDUSTRIAL

LARGE CAPACITY FILTER SYSTEM



Top view of Filter Unit, illustrating arrangement of filter baffles as they are locked in the chamber. View also shows precoat of filter aid as it is deposited uniformly on the surface of the filter cloth.

Designed to provide adequate filtration on large automatic plating machines. Arrangement consists of filter, pumping unit, primer-strainer unit, mixing tank, control valves, fittings and piping. These features facilitate the convenient use of filter aids and purifying agents, making it an ideal continuous filtration system, equally effective for intermittent filtering. Systems are provided for either acid or alkaline solutions in sizes with up to 550 sq. ft. of filtration area.

INDUSTRIAL filters equipped with AIR WASH CLEANING FEATURE have been in operation for months without removing the cover. It is only necessary to remove the cover when new filter cloths are installed or for periodical inspection.

This time and labor saving method can only be used with our closed type vertical filters.

INDUSTRIAL FILTER & PUMP MFG CO.

1621-39 WEST CARROLL AVENUE CHICAGO 12, ILLINOIS

AVAILABLE BRANCH SPEAKERS 1948-1949

Complete list on pages 754-757

THE TASK OF compiling a list of available speakers for Branch educational functions is formidable. It is hoped, therefore, that the Branches make good use of it. The subjects offered embrace practically every phase of metal finishing, and capable speakers assure an able presentation of up-to-the-minute information. With early publication the members can determine what they wish to hear during the coming season and so instruct the librarian, who in turn can arrange, well in advance, the entire year's program.

The response to the invitation to appear on the speakers' list was eager and generous. The Branches have established a reputation for courteous reception of speakers which, in combination with good turnouts and lively discussions, has resulted in greater response from potential speakers than ever before.

Almost without exception, companies, in agreeing to furnish speakers, have asked that the Branches give notice reasonably far in advance. The men listed have definite responsibilities to their companies which can be put aside only when ample notice is provided. In addition, this makes it possible for the speaker to plan other work in the branch territory.

Most of the members of the Executive Board are not listed for talks on plating topics. There is some feeling that when an A. E. S. Officer makes a Branch visitation, members prefer to hear about the Society's organization, board actions, etc., and to have the opportunity to ask questions or air grievances. Such a program can easily consume a meeting night and prove a benefit to the individual members, the Branch and the Society. While it is the policy of the Executive Board to have each Branch visited by at least one of its members during the year, it is sometimes difficult of accomplishment. All the board members hold responsible positions which they cannot leave at will to visit a distant Branch. However, when a specific invitation is extended to an A. E. S. Officer, he will make every effort to come.

Within itself, the Society has a source of speakers without equal: the Research Committee and its organization. This is an unique research group in many ways. Its attack on the various projects is a model of efficiency, and the researches are prosecuted with skill and dispatch. Many Branches have adopted a policy of reserving at least one meeting each year for a speaker connected with the research program. Such a policy has a twofold benefit: it brings direct to the Branch the results of *its own* researches and it lets the Research Committee know that the members of the Society appreciate its efforts.

In the June issue of PLATING is charted the entire organization and personnel of the research organization. Preliminary arrangements for obtaining a speaker from the research personnel should be made with the Committee Chairman, Dr. Louis Weisberg, 71 W. 45th Street, New York City. Unless a definite speaker is requested, he can recommend the best qualified person to present the subject or material desired. Many of these persons do not have industrial backing to cover expenses of a Branch visit and should be reimbursed for such expense. Determine early your choice of speaker or project to be covered and make your appointments well in advance. Help your research program and it will help you.

Undoubtedly there have been some companies and individuals to whom invitation has not been extended to join the array of speakers. This has not been deliberate but an oversight, and an apology is hereby offered. If they will accept the apology and submit details for inclusion in the list, the information will be published in a supplementary listing. The Educational Chairman, for the membership, wishes to thank the listed companies and individuals for their fine and generous cooperation.

S. S. JOHNSTON,
Educational Chairman.

ALLIED RESEARCH PRODUCTS, INC. (c)*
4004 E. Monument St., Baltimore 5, Md.—Middle Atlantic and Midwest
Contact H. C. IRVIN, Manager
Subject:
Iridite

ALUMINUM CO. OF AMERICA (c)
New Kensington, Pa.—Middle Atlantic and Midwest
Contact R. VANDEN BERG, Finishes Development Section, Jobbing Division
Subject:
Finishes for Aluminum Alloys

AMERICAN CHEMICAL PAINT CO.
Ambler, Pa.—(c) East and (partial b)† Midwest
ALFRED DOUTY, Chief Chemist
Subject:
Pickling Inhibitors:
JOSEPH MAZIA
Subjects:
Cleaning of Zinc Base Die Castings
Treatment of Zinc Base Die Castings Preparatory to Painting
F. P. SPRUANCE, JR.
Subject:
Alodizing Aluminum

AMERICAN CYANAMID CO. (c)
Ion Exchange Products Department, 30 Rockefeller Plaza, New York 20, N. Y.—East and Midwest
M. C. WELKER, Sales Supervisor
Subject:
Recent Developments in the Use of Ion Exchange Resins in the Plating Room

AMERICAN ELECTROPLATERS' SOCIETY (c)
P. O. Box 168, Jenkintown, Pa.—East and Midwest
ALLAN RAY PUTNAM, Advertising Manager
Subject:
Plating—The Official Organ of the American Electroplaters' Society

AMERICAN ELECTROPLATERS' SOCIETY
Research Committee
DR. LOUIS WEISBERG, Chairman, 71 W. 45th Street, New York 19, N. Y.
The entire personnel of the research organization is listed in the June issue of PLATING. Contact Dr. Weisberg for speaker desired.

BART-MESSING CORPORATION (c)
45 Morgan Ave., Brooklyn 6, N. Y.—Any Branch
E. R. REDLHAMMER, Chief Engineer
Subject:
Power Rectification for Plating
EDWIN C. RINKER
Subjects:
Plating of Precious Metals
Formulation and Use of Cleaners
BENJAMIN S. FLUG
Subjects:
Bright Nickel Plating
Plant Design and Layout for Manual, Semi-automatic and Full-automatic Plating

BEHR-MANNING CORP. (c)
Troy, N. Y.—Any Branch
Contact H. J. SIDFORD, Manager, Sales Promotion Division
Subject:
Coated Abrasives and Their Applications

BETHELEM STEEL COMPANY (c)
Bethlehem, Pa.—East and Midwest
Contact S. H. YORKS, Publications Department
Selected subjects

L. C. BORCHERT (b)
Chicago Bumper Division, Houdaille-Hershey Corporation, 1455 W. 38th St., Chicago 9, Ill.—Midwest
Subject:
Copper, Nickel and Chromium Plating with Special Consideration to Plate Distribution, Testing of Deposits, Anode Studies, etc.

BROWN INSTRUMENT CO. (c)
Philadelphia 44, Pa.—Any Branch
Contact R. R. WEST, Manager, Equipment Manufacturers Division
Subject:
Temperature Control in Plating Operations

DARCO CORPORATION (c)
60 E. 42nd St., New York 17, N. Y.—East and Midwest
W. A. HELBIG, Chemical Engineer
Subject:
Purification of Electroplating Solutions by Filtration and Activated Carbon Treatment

DIVINE BROTHERS COMPANY (c)
200 Seward Ave., Utica 1, N. Y.
Contact WILLIAM C. BEDDOE, Advertising Manager
Subject:
Polishing and Buffing Wheels

THE DORR COMPANY (c)
570 Lexington Ave., New York 22, N. Y.—Any Branch
Contact ANTHONY ANABLE, Director of Public Relations
Subject:
De-Ionized Water for Electroplating
Other selected subjects

THE DURIRON COMPANY (c)
P. O. Box 1019, Dayton 1, Ohio—Any Branch
WALTER LUCE, Metallurgical and Chemical Engineer
Subject:
Alloys for Handling Corrosive Plating Solutions

ENTHONE, INC. (c)
442 Elm St., New Haven 2, Conn.
DR. WALTER R. MEYER, President—East and Midwest—Subjects 1–4
HUBERT M. GOLDMAN, Chemical Engineer—East and Midwest—Subjects 1–2
Subjects:
1. *Plating Upon Aluminum*
2. *Preparation of Metals for Electroplating*
3. *Cleaning and Blackening of Metals*
4. *Coloring and Blackening of Metals*

FORMAX MFG. CORP. (c)
12934 Evergreen, Detroit 23, Mich.—All localities
H. J. MCALEER, President
E. W. MCALEER, Vice-President
Subject:
Practical Facts About Polishing and Buffing Compounds and Wheels

GENERAL ELECTRIC CO. (c)
Rectifier Division, 1285 Boston Ave., Bridgeport 2, Conn.—Any Branch
Contact I. A. LEE, Sales Manager
Subject:
Rectifiers

GENERAL MOTORS CORP. (c)
Research Laboratories Division, P. O. Box 188, North End Station, Detroit 2, Mich.—Any Branch
W. M. PHILLIPS, Head, Electro-Chemistry Department
F. L. CLIFTON, Assistant Head, Electro-Chemistry Department
Subject to be selected

GRAHAM, CROWLEY AND ASSOCIATES (b)—½ and (c) ½
471 York Road, Jenkintown, Pa.—East of Mississippi River
DR. A. KENNETH GRAHAM, President
Subjects:
Electroplating Copper-Zinc Alloys
Electroplating Noble Metal Alloys
Stress in Electrodeposits

W. GREEN ELECTRIC CO. (c)
130 Cedar St., New York 6, N. Y.—East Middle Atlantic and North Central
L. W. REINKEN, Chief Engineer
Subject:
Rectifier Equipment for Electroplating

FREDERICK GUMM CHEMICAL CO., INC. (c)
538–542 Forest St., Kearny, N. J.—New England and Middle Atlantic
A. S. KOHLER, Chief Chemist
Subjects:
Barrel Deburring and Burnishing
Cleaning of Wrought Aluminum

HANSON-VAN WINKLE-MUNNING CO. (c)
Matawan, N. J.—East and Midwest
MYRON B. DIGGIN, Subject 1
PAUL J. LA LONDE, Subject 1, East and

†(b) Expenses paid by Branch *(c) Expenses paid by Company

2, Midwest
ALLEN T. BALDWIN, Subject 3
MARTVIG J. MOLL, Subject 4
D. GARDNER FOULKE, Subjects 1 and 5
1920 Carroll Ave., Chicago 12, Ill.
RAYMOND F. LEDFORD, Subject 1, Midwest and 3, East and Midwest
Curtis Building, 2842 W. Grand Blvd., Detroit 2, Mich.
BERNARD C. CASE, Subject 1, Midwest
West Coast Branches by special arrangement
Subjects (by type):
1. *Plating and Electrochemical*
2. *Electrotyping and Stereotyping*
3. *Hot Galvanizing and Hot Tinning*
4. *Automatic Electroplating Equipment* (with moving pictures)
5. *Magnesium Anodizing*

HARSHAW CHEMICAL CO. (c)
1945 E. 97th St., Cleveland 6, Ohio—Middle Atlantic and Midwest
DR. M. M. BECKWITH, Manager of Technical Sales—Electroplating
A. H. DU ROSE, Technical Service—Electroplating
Subject to be selected

R. O. HULL & COMPANY, INC. (c)
1279 W. 3rd St., Cleveland 13, Ohio—East and Midwest
R. O. HULL, President
JACK WINTERS, Research Chemist
EDWARD WILDS, Technical Representative
Selected subjects

ILLINOIS WATER TREATMENT CO. (c)
Rockford, Ill.—Midwest
W. S. MORRISON, Vice-President
F. H. KAHLER, Sales Manager
L. B. PORTER, Director of Research
Subject:
Demineralized Water for the Plating Industry

INDUSTRIAL FILTER AND PUMP MFG. CO. (c)
1621-1639 W. Carroll Ave., Chicago 12, Ill.—East of Mississippi River
HAROLD W. FAINT, 2034 Lakeway Ave., Kalamazoo 28, Mich.
Subject:
Filtration of Plating Solutions (with or without demonstration)

INDUSTRIAL LINING ENGINEERS, INC. (c)
Sewickley, Pa.—East of Mississippi River
KENNETH TATOR, President
Subjects:
Control of Corrosion in the Plating Room
The Application of Plastics to Plating

INTERCHEMICAL CORP. (c)
Finishes Division, 57 State St., Newark 1, N. J.—Middle Atlantic, Midwest and West Coast
Contact E. D. HORGAN, Manager of Sales Promotion
Subject:
Organic Finishing

INTERNATIONAL NICKEL CO. (c)
67 Wall St., New York 5, N. Y.—East and Midwest
W. H. PRINE
Subject:
Industrial Nickel Plating
C. H. SAMPLE
Subjects:
Specifications and Tests for Electrodeposited Coatings
Corrosion Behavior and Protective Value of Electrodeposited Coatings

LASALCO, INC. (c)
2820–2830 La Salle St., St. Louis 4, Mo.
B. G. DAW, President—East, Middle Atlantic, Midwest and West; (b) Far West
H. J. STRUCKHOFF, Vice-President—East, Middle Atlantic, Midwest
A. J. BIGNALL, Sales Engineer—East, Middle Atlantic, Midwest
Subject:
Mechanical Plating and Tumbling

LEA MANUFACTURING CO. (c)
16 Cherry Ave., Waterbury 86, Conn.
RICHARD P. CRANE, Vice-President—East, Middle Atlantic and Midwest
Subject:
Surface Finishing
DR. HENRY L. KELLNER, Technical Director—East and Middle Atlantic
Subject:
Polishing and Buffing
ELLSWORTH T. CANDEE, Director of Research—East
Subject:
Metal Finishing Research
WESLEY L. CASSELL, Field Engineer—East
Subject:
Developments in Plating Equipment

LUPOMATIC INDUSTRIES, INC.
4510 Bullard Ave., New York 66, N. Y.—East (c) and Midwest (partial b)
LAVERNE VERZIER, Director of Development
Subject:
Lustrous Finishes by Tumbling Methods

DR. F. C. MATHERS (b)
Department of Chemistry, Indiana University, Bloomington, Ind.—East and Midwest
Subjects:
Effect of Small Quantities of Material in Chemical Production
Accidental Discoveries
Stripping of Copper from Base Metals
The Rarer Elements
Effect of Addition Agents in the Electrodeposition of Various Metals

MINE SAFETY APPLIANCES CO. (c)
Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.—Any Branch
312 Ivy St., N. E., Atlanta 3, Ga.
F. A. KING, Manager
412 Water St., Baltimore 2, Md.
C. R. DEVER, Manager
310 Copley Square Building, 30 Huntington Ave., Boston 16, Mass.
J. J. DEVER, Manager
1718 Main St., Buffalo 8, N. Y.
W. G. KULESZ, Manager
4349 W. Armitage Ave., Chicago 30, Ill.
GEORGE KNOLL, Manager
10016 Carnegie Ave., Cleveland 6, Ohio
J. W. McCRACKIN, Manager
8926 Second Blvd., Detroit 2, Mich.
H. N. GRUBER, Manager
82 Fulton St., New York, N. Y.
H. J. SEGRAVE, Manager
325 Wall St., Los Angeles 13, Calif.
J. S. MOORE, Manager
1105 N. Water St., Milwaukee 2, Wis.
F. G. GRABAU, Manager
30 Fulton St., Newark 2, N. J.
E. M. McCOOL, Manager
5564 Baltimore Ave., Philadelphia 43, Pa.
E. C. BRAINERD, Manager
918 F St., N. W., Washington 4, D. C.
W. T. COFER, JR., Manager
556 N. Skinker Blvd., St. Louis 5, Mo.
R. V. FITZPATRICK, Manager
Subjects:
Health and Safety Hazards in Plating Operations (includes demonstration of personal protective equipment)
The Air We Breathe (26-minute, 16-mm sound movie with a short talk)

MINNESOTA MINING AND MANUFACTURING CO. (c)
900 Fauquier Ave., St. Paul 6, Minn.—Any Branch
New Methods Sales Engineers
367 Grove St., St. Paul, Minn.
E. L. GOTHIER
900 Fauquier Ave., St. Paul 6, Minn.
S. L. JOHNSON
1500 South Western Ave., Chicago 8, Ill.
R. K. GRINDEN
H. J. HAMM
911 Plaza Bldg., Pittsburgh 19, Pa.
R. G. HALL
401 N. Broad St., Philadelphia 8, Pa.
O. L. PEDERSEN
Sleeper St., Boston 10, Mass.
D. G. SUTLIFF
155 Ave. of the Americas, New York 13, N. Y.
L. S. STERNAL
6411 Randolph St., Los Angeles 22, Calif.
J. M. PITBLADO
411 Piquette Ave., Detroit 2, Mich.
FRANK ZOCCOLA
Room 711, c/o Central Terminal Building, 710 N. 12th St., St. Louis 1, Mo.
T. R. LANDIS
Subject:
Use and Application of Coated Abrasives

MILTON NADEL (b)
41–15 Fiftieth Ave., Long Island City 4, N. Y.
Supervisor of Metal Finishing, Consolidated Razor Blade Corp., Jersey City, N. J.
Subject:
Surface Finishing of Aluminum and Its Alloys

NATIONAL BUREAU OF STANDARDS (b) and partial (c) under special conditions
Washington 25, D.C.—East and Midwest
DR. ABNER BRENNER
Subjects:
Deposition of Tungsten Alloys
Electroless Plating of Nickel and Cobalt
Physical Properties of Electrodeposited Nickel
SEYMOUR SENDEROFF
Subject:
Stress in Electrodeposits
EUGENIA KELLOGG
Subject:
Magne-gage for Composite Copper-Nickel Coatings on Steel
DR. VERNON A. LAMB
Subject:
Control of Trivalent Chromium in Chromic Acid Baths

NATIONAL TECHNICAL LABORATORIES (c)
Beckman Instruments Division, South Pasadena, Calif.—Any Branch
DR. A. O. BECKMAN, Director
T. F. HERRING, Sales Manager
R. W. MOULTON
141 Englewood, Brookline 46, Mass.—New England and New York
E. C. BOWEN

8505 Hazelwood Drive, Bethesda 14, Md.—South East, including Pennsylvania and Ohio
DR. ELDEN D. HALLER
9 S. Clinton St., Chicago 6, Ill.—Midwest
GEORGE R. KINCAID
National Technical Laboratories, South Pasadena, Calif.—Pacific Coast
W. W. BLALOCK
Subjects:
pH and Its Control in Plating Operations
Determination of Impurities in Plating Solutions by Use of the Beckman Quartz Spectrophotometer

NORTON COMPANY (c)
Worcester 6, Mass.—Any Branch
Contact Technical Service Section
Subject:
Polishing with Abrasives and related subjects

NUTMEG CHROME CORPORATION
79 Chapel St., Hartford 3, Conn.—New England (c), Middle Atlantic and Midwest (partial b)
A. W. LOGOZZO, President
Subjects:
Bright Nickel and Decorative Chrome
Hard Chrome Problems

OAKITE PRODUCTS, INC. (c)
22 Thames St., New York 6, N. Y.
Contact DR. DONALD PRICE, Technical Director
Selected subjects concerning:
Industrial and Chemical Cleaning
Surface Treatments
Preparing Surfaces for Finishes

ONEIDA, LTD. (c)
Works Laboratory, Oneida, N. Y.—New York State and New England
DANIEL GRAY, Chief Chemist
Subject:
Electropolishing of Silver

OSBORN MANUFACTURING CO. (c)
5401 Hamilton Ave., Cleveland 14, Ohio—East, Midwest and, by special arrangement, West Coast
F. T. TURNER, Assistant Sales Manager
A. J. CHANDLER, Sales Engineer
C. W. NEWMAN, Sales Engineer
Subject:
Brush Method of Surface Finishing—Development of New Techniques in Brush Applications

PARKER RUST PROOF CO. (c)
2177 E. Milwaukee Ave., Detroit 11, Mich.—East and Midwest
F. J. DE WITT, General Sales Manager
M. B. ROOSA, Assistant General Sales Manager
DR. R. C. GIBSON, Technical Director
Subjects:
Preparation of Metals Prior to Painting
Corrosion Preventive Phosphate Coatings
Phosphate Coating of Bearing Surfaces to Retard Wear
Bonderizing of Metals to Facilitate Drawing
Bonderizing of Aluminum To Increase Paint Adhesion

WALTER L. PINNER (b)
9120 Roselawn Ave., Detroit 4, Mich.—East and Midwest
Manager of Research, Houdaille-Hershey Corporation
Subject:
Copper, Nickel and Chromium Plating with Special Consideration to Plate Distribution, Testing of Deposits, Anode Studies, etc.

POOR & COMPANY, (c)
Promat Division, 851 S. Market St., Waukegan, Ill.—East of the Mississippi River
A. E. CHESTER, Director of Research
BRUNO LEONELLI, Detroit District Manager
Subject:
Modern Practices and Probable Trends in the Deposition of Cadmium and Zinc

PROCESS EQUIPMENT CORP. (c)
307 N. Michigan Ave., Chicago 1, Ill.—Any Branch
P. B. CARTER, JR., Chemical Engineer
2424 Enterprise St., Los Angeles 21, Calif.
JACK F. BEALL
Subjects:
De-Ionization of Water for Plating
Disposal and Recovery of Plating Room Water and Solutions

FOSTER D. SNELL, INC. (c)
29 W. 15th St., New York 11, N. Y.—East and Middle Atlantic
DR. FOSTER DEE SNELL, President
Subject:
Detergency and Surface Activity (with lantern slides)

SPARKLER MFG. CO. (c)
Mundelein, Ill.—East and Midwest
A. C. KRACKLAUER
W. J. KRACKLAUER
K. L. CARR
Subject:
Filtration Problems in the Electroplating Industry

STANDARD PLATING RACK CO. (c)
1913–1925 N. Paulina St., Chicago 22, Ill.—East of Mississippi River
FRANK K. SAVAGE, Vice-President
Subjects:
Plating Racks
Electroforming
Wage Incentives
Plating Room Management

STANDARD STEEL SPRING CO. (c)
Coraopolis, Pa.—East, Middle Atlantic and North Central
G. B. BOWMAN, Chief Chemist
Selected subjects

STURGIS PRODUCTS CO. (c)
203 Jacob St., Sturgis, Mich.—Midwest
C. H. CASTLE, Technical Director
Subject:
Mechanical Finishing by the Roto-Finish Processes

SULPHUR PRODUCTS CO., INC. (c)
Greensburg, Pa.—Any Branch
WILFRED S. MCKEON, President
Subject:
Stripping Copper—Non-Dangerously

TECHNIC, INC. (c)
39 Snow St., Providence 3, R. I.—East
FRANK K. SMITH, President
DR. EDWARD A. PARKER, Technical Director
Subject:
Contemporary Gold Plating

THE UDYLITE CORP. (c)
Detroit 11, Mich.—East and Midwest
WILLIAM JACKSON, Engineer
Subject:
Barrel Plating
JOHN DAVIS, Chief Engineer
Subject:
Automatic Plating Equipment
GUST KENTTA, Engineer
Subject:
Plating Room Layout
DR. R. B. SALTONSTALL, Technical Director
General electroplating topics

UNITED-CARR FASTENER CORP. (b)
Cambridge 42, Mass.—New England

LEONARD A. CHESWORTH, Chief Chemist
Subject:
Barrel Finishing

UNITED CHROMIUM, INC. (c)
Any Branch—Contact speaker nearest branch location
Waterbury 90, Conn.—East
DR. G. DUBPERNELL, Subjects 1, 7
M. SHACAT, Subjects 1–5
W. GAUNT, Subject 5
51 E. 42nd St., New York 17, N. Y.—East
H. MALSTEDT, Subjects 1–5
R. K. GUFFIE, Subjects 2–5
F. FULFORTH, Subjects 4, 5
E. N. RIOTTE, Subjects 4, 5
Carteret, N. J.—East
D. E. HARTMAN, Subject 6—East and Midwest
D. MESERVE, Subject 6
F. L. SCOTT, Subject 6
2751 E. Jefferson Ave., Detroit 7, Mich.—Midwest
W. S. CIBULSKIS, Subjects 1, 2
R. H. DUDLEY, Subjects 1, 2, 4, 5
C. H. ELDRIDGE, Subjects 2, 4, 5
J. J. HANNEY, Subjects 2, 5
L. M. WEISS, Subject 2
DR. J. E. STARECK, Subjects 3, 4
A. M. LINN, Subject 3
C. G. MILLER, Subject 4
208 S. La Salle St., Chicago 4, Ill.—Midwest
E. M. RELITZ, Subjects 1, 4, 5
C. W. CARTER, Subjects 1, 2, 4–6
505 Commercial Building, Dayton 2, Ohio—Midwest
L. A. CRITCHFIELD, Subjects 2, 4–6
E. W. REHME, Subjects 2, 6
4536 District Blvd., Los Angeles 11, Calif.—West
R. J. WOOLEY, Subjects 1, 2, 4–6
J. F. MARTIN, Subjects 1, 2, 4–6
D. F. EDWARDS, Subjects 1, 2, 4–6

UNITED CHROMIUM, LTD.
15 Emily St., Toronto, Canada
JAMES GUFFIE, Subjects 1, 2, 4–6
Subjects:
1. *Chromium Plating*
2. *Copper Plating from Pyrophosphate Baths*
3. *Electrocolor and Patternplate*
4. *Anozinc and Dip Conversion Coatings for Zinc*
5. *Rack Coatings and Plating Stop-offs*
6. *Organic Finishes and Protective Coatings*
7. *Plating Literature*

UNITED STATES STONEWARE CO. (c)
60 E. 42nd St., New York 17, N. Y.—East and Middle Atlantic
S. A. LEWIS
Subject:
Corrosion Resistant Materials in the Electroplating Industry

WALLACE & TIERNAN CO., INC. (c)
Newark 1, N. J.—East and Middle Atlantic
JOHN G. DOBSON, Technical Service Division
Subject:
Treatment of Plating Room Waste

WEIRTON STEEL CO. (c)
Weirton, W. Va.—East and Midwest
S. S. JOHNSTON, Technical Director, Tin Mill Electrolytic Department
Subjects:
High Speed Tin Plating of Wide Strip Steel
Continuous Zinc Plating of Wide Strip Steel

WESTERN ELECTRIC CO. (c)
Hawthorne Station, Chicago 23, Ill.—East and Midwest
Contact A. C. JONES, Works Engineer of Manufacture
DR. R. E. HARR, Dept. 6634, Subject 1
C. E. FISCHRUPP, Dept. 6634, Subject 2
100 Central Ave., Kearny, N. J.—East
Contact Mr. H. ROSSBACHER, Works Engineer of Manufacture
W. F. WEBER, Dept. 8241, Subject 3
S. E. BARR, Dept. 8241, Subject 4
W. A. GRIGAT, Dept. 8241, Subject 5
Subjects:
1. *Theory and Practice of Electrochemical Deposition of Such Metals as Gold, Silver, Tin, Zinc, Copper, Nickel and Chromium*
2. *Current Industrial Plating Methods, Particularly by Means of Semi-Automatic Equipment, Zinc, Nickel and Chromium*
3. *The Role of Personal Protective Equipment in the Plating Room*
4. *Continuous Tin Plating of Fine Gage Phosphor Bronze and Beryllium Copper Wire*
5. *Rapid Qualitative Determinations for Metallic Coatings*

WYANDOTTE CHEMICALS CORP. (c)
Wyandotte, Mich.—East and Midwest
DR. ROY E. HEATH, Manager Industrial Department
EVANS S. SCHMELING, Assistant Manager Industrial Department
Subject:
Alkalies in Metal Cleaners
DR. L. E. KUENTZEL, Head, Physics Section
Subject:
Application of Physical Methods to Electroplating Problems (electron microscope, X-ray diffraction, etc.)
LOWELL McCOY, Section Head, Industrial Research Laboratory
Subject:
Barrel Finishing

ZAPON DIVISION (c)
Atlas Powder Company, North Chicago, Ill.—Midwest
HARRIS G. BECK, JR., Technical Director
Subjects:
The Manufacture and Testing of Industrial Finishes (includes a 20-minute film showing manufacturing procedures in a paint plant)

Electroplating MOTORS GENERATORS

in stock
Reliably Rebuilt
with our
1 YEAR GUARANTEE

6/12 Volts

1—8000/4000 Ampere, H-V-W Synch. M. D. 300 RPM
2—6000/3000 Ampere, B. & O'C. with Chandeysson synch. motor, 450 RPM
2—5000/2500 Ampere, B. & O'C. with Chandeysson synch. motor, 450 RPM
1—5000/2500 Ampere, Columbia, 690 RPM
1—2000/1000 Ampere, H-V-W, 690 RPM
1—1250/625 Ampere, H-V-W, 850 RPM
1—1000/500 Ampere, Chandeysson, 690 RPM
1—1000/500 Ampere, Columbia, 1150 RPM
1—1000/500 Ampere, H-V-W, 1150 RPM
8—125 Ampere Hobart, 6 volts

12/24 Volts

1—1000/500 Ampere, H-V-W synch. M. D. 900 RPM
1—3000/1500 Ampere, Chandeysson Synch. M. D. 400 RPM

10 V. to 60 V.
Single Commutator

1—200Ampere, 11/15 V. Gen. Elec.
1—180Ampere, 14/18 V. Gen. Elec.
1—200Ampere, 15 V. Master
1—1000 Ampere, 15 V. Gen. Elec.
1—300 Ampere, 15 V Star
1—800 Ampere, 22/32 V Gen. Elec.
3—1500 Ampere, 20 V. Elec. Prods.
1—67 Ampere, 24 V. West.
1—600 Ampere, 24 V. Reliance
1—200 Ampere, 25 V. Star
1—1000 Ampere, 25/35 V. Diehl
1—300 Ampere, 25 V. Star
1—175 Ampere, 25 V. Cr. Wh.
1—500 Ampere, 32 V. Columbia
2—100 Ampere, 30 V. Gen. Elec.
1—200 Ampere, 30 V. West.
2—200 Ampere, 32 V. Gen. Elec.
2—1500 Ampere, 32/40 V. Elec. Prods.
1—1000 Ampere, 33 V. Gen. Elec.
2—200 Ampere, 42 V. Gen. Elec.
3—1500 Ampere, 45 V. Century
1—1500 Ampere, 50 V. Gen. Elec.
2—800 Ampere, 50 V. Gen. Elec.
1—400 Ampere, 50 V. Gen. Elec.
6—1500 Ampere, 50 V. Elec. Prods.
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Branch News

ADELAIDE BRANCH

The October meeting featured a paper on "Cleaners and Cleaning Compound in the Electroplating Trade" by MR. C. J. COCKS.

The Annual Smoke Social was held in November in the British Tube Mills' Social Club Hall. It was a well-organized and thoroughly entertaining evening—droughtless but not draughtless.

Following the Christmas vacation, the Branch activities were resumed with full vigor with the February meeting. MR. V. HAWKES, Chemist with Wiles Chromium and Electroplating Company, gave an excellent paper on "Bright Nickel Plating" with special attention to the nickel-cobalt-formaldehyde type of bath. It aroused a great deal of discussion.

The March meeting was Problem Night when each member found that he was not alone in having problems, at least little ones. All questions were answered satisfactorily, except one about scum formulation in cadmium cyanide solutions containing sulfonated castor oil and nickel.

MR. B. DAY of the Robert Bryce & Company, Ltd., was the speaker at the April meeting. His subject was "Bright Dipping and Coloring of Metals". A greatly appreciated new feature was the distribution before the address of copies of the formulas referred to, which enabled the members to follow the speaker more closely.

C. J. COCKS, *Secretary.*

BALTIMORE-WASHINGTON BRANCH

About thirty were present at the meeting on April 6 in the National Bureau of Standards.

DR. CARL ZAPFFE, Consulting Metallurgist, Baltimore, Md., spoke on "Pickling and Plating Brittleness". He presented a very interesting talk with unusual experimental evidence for hydrogen embrittlement in base metals which is caused by pickling and plating, and illustrated his talk with over sixty slides of graphs and photomicrographs. The data are primarily the result of single bend tests and fractography.

GRACE RIDDELL, *Secretary.*

BALTIMORE-WASHINGTON BRANCH

The Baltimore-Washington Branch met on May 4 at the American Hammered Piston Ring Company in Baltimore. About forty were present.

MISS GENE KELLOGG, MISS GRACE RIDDELL, and DR. ABNER BRENNER, all

of the National Bureau of Standards, shared the program. Miss Kellogg spoke on "Measuring Thickness of Composite Coatings". Miss Riddell and Dr. Brenner accompanied their talk on "Electroless Nickel and Cobalt Deposition" with some very interesting demonstrations of the new process.

FIELDING OGBURN, *Secretary.*

BOSTON BRANCH

Two applicants were elected to membership at the May 6 meeting and one new application was turned over to the Board of Managers. MANSON GLOVER reported for the Branch Constitution Committee: all work to date had been completed and the final results of the labors of the Constitution Revision Committee printed in the April issue of PLATING. He also reported on the success of the 13th Annual Technical Session and Banquet held April 17 in Hotel Statler with four hundred and twenty-two attending.

L. V. GAGNON, G. P. SWIFT and A. W. GARRETT were elected Delegates, and M. GLOVER, L. A. CHESWORTH and A. W. COLLINS alternates to the Annual Convention. W. LARSSON, J. SULLIVAN and S. BAKER were appointed to the Nominating Committee to bring in a slate for the Branch election in June. It was voted to add the following to the Branch By-Laws: The secretary shall be returned annually as one of the Delegates to the Annual Meeting of the Society and shall represent the Branch at all New England, New York City and Newark Annual Technical Sessions and Banquets with expenses paid by the Branch.

MR. HENRY STROW of MacDermid, Inc., was then introduced by Librarian Glover and discussed "Bright Copper Plating". Mr. Strow, who spoke very easily and convincingly, treated both acid and cyanide copper solutions. The latter were discussed in greater detail as to effects of rochelle salts, metal, free cyanide, and caustic contents, temperature, agitation, equipment and filtration. Impurities such as organic matter, carbonate, nickel, lead and zinc were given special attention, and methods of control and removal were given. Chromium and cleaner contamination was treated at length as well as wetting agents. A long discussion period followed.

GEORGE P. SWIFT, *Secretary.*

BRIDGEPORT BRANCH

Forty-one members and guests attended the monthly meeting on April 2.

RAY GORAL and F. B. GOTTHARDT reported on the progress being made by the Banquet Committee. The Sick Committee announced the serious illness of WILLIAM A. EHRENCRONA'S father. He died the following day, and the Branch expressed its sympathy to the family with flowers.

The election for the year 1948–1949 gave the following results:

President—CHARLES S. TEMPLE
First Vice-President—CARL SCHAEFER
Second Vice-President — ANTHONY J. CHENIS
Secretary-Treasurer—JOSEPH A. STERLING
Librarian—ARTHUR R. MCNEIL
Sergeant-at-Arms—ANTHONY SALVAGGIO
Board of Managers—WILLIAM THOMPSON, WILLIAM FLAHERLY, WILLIAM EHRENCRONA, FRED B. GOTTHARDT
Delegates—ARTHUR R. MCNEIL, CHARLES L. TEMPLE, JOSEPH G. STERLING
Alternates—JOSEPH GANIM, CARL SCHAEFER, V. S. CONSALVO

The membership changes include three elections, one resignation, two suspensions, and one out-transfer. There was one new applicant for membership.

It was decided to start the meetings promptly at 8:00 P. M. and to devote normally no more than one-half hour to business.

JOSEPH G. STERLING,
Secretary-Treasurer.

BRIDGEPORT BRANCH

The Open Meeting and Educational Session on April 16 was held in the Pitney-Bowes & Company, Inc., Auditorium, Stamford, Conn., and attended by seventy members and guests.

PRESIDENT F. B. GOTTHARDT called upon A. J. CHENIS to preside as Technical Chairman.

MR. RALPH MCCAHAN, E. I. du Pont de Nemours & Company, Electrochemical Division, spoke about "Trouble Shooting on Cyanide Plating Solutions". (See Boston Branch report in May issue.) Pictures were shown which illustrated the handling of cyanide solutions. The session proved most interesting and provoked considerable discussion.

Following a plant visitation to which an invitation had been extended by MR. WILLIAM A. ROSS of the host company, refreshments were served which deserve special mention.

JOSEPH G. STERLING,
Secretary-Treasurer.

BUFFALO BRANCH

The April 9 meeting was highlighted by the presence of MR. ROBERT K. GUFFIE of United Chromium, Inc., who spoke about "Unichrome Copper". Mr. Guffie's presentation was especially interesting in view of the many personal experiences he has had with the Unichrome copper bath in the field.

It is interesting to note that this bath was discovered quite by accident by Dr. Stareck during his early experiments with Electrocolor. The deposit obtained is unusually fined grained and extremely ductile. Despite the ductility, it is possible to get a deposit that is bright and does not require buffing. Mr. Guffie was frank to admit that though the bath had many advantages it was not devoid of disadvantages. Those assembled were convinced that here is a good competitor with the bright cyanide copper baths.

JOE RUFF, Chairman of the Picnic Committee, reported that the Rochester Branch was in accord with the idea of holding a joint picnic this summer. It was also reported that the plans for a special Fall Educational Session are going full steam ahead. It was good news to hear that SIEBERT JOHNSON is on the mend again after a serious operation and that he will be back soon.

H. A. FUDEMAN, *Secretary.*

CHICAGO BRANCH

The April meeting was held at the Atlantic Hotel, with ninety-five members and guests present. The main item of business was the election of officers. The candidates recommended by the Nominating Committee were elected unanimously. The officers for next year will be:

President—M. LONGFIELD
First Vice-President—P. P. GLAB
Second Vice-President—J. BOUDREAU
Secretary-Treasurer—J. M. ANDRUS
Librarian—J. H. MONAWECK
Board of Managers—O. T. TOWNER, C. KELLY, L. V. VINN

The speaker of the evening was MR. A. J. CHANDLER of the Osborn Manufacturing Corporation, who delivered a very good talk on the use of brushes in the metal finishing field. He also had slides showing the types of finishes obtained from the different brushing operations.

After the lecture PRESIDENT O. T. TOWNER presented his movies of plating operations at the J. P. Seeburg Corporation. The pictures were accompanied by a complete verbal explanation of operation sequences for both polishing and buffing.

With some of many questions in the question box provoking discussion, a very profitable evening was had by all.

J. H. MONAWECK, *Librarian.*

CINCINNATI BRANCH

The April 28 meeting in the Cincinnati Engineers Club began with a dinner attended by twenty-five persons. Afterwards, a movie of the Cincinnati Municipal Master Plan was shown, which proved of interest to all.

The election of officers for the coming year gave the following results:

President—WILLIAM P. ALBOHN
Vice-President—PHIL S. BLICKENSDERFER
Librarian—FRED G. BRUNE
Secretary—H. ROPER DAVIS
Treasurer—CHARLES T. NUZUM

The speaker of the evening was DR. M. M. BECKWITH of Harshaw Chemical Company, who gave a very interesting and engaging talk to the thirty-seven

members and visitors present on the subject, "Copper Fluoborate Plating". The high current densities and corresponding high deposition rates which this type bath allows coupled with the fine-grained deposits obtained produced a lively interest in the audience and brought out many searching questions.

H. R. DAVIS, *Secretary.*

DAYTON BRANCH

The Delegates to the 1948 National Convention elected at the April 9 meeting are: L. A. CRITCHFIELD, A. J. KLEIN, and D. H. HUFF. W. G. CRYDERMAN, W. MOLINE and F. BAUCH were elected alternates.

We were honored with a visit by A. E. S. THIRD VICE-PRESIDENT WILLIAM J. NEILL who discussed the Society's activities, functions and aims and invited comments to aid the Executive Board in fulfilling the desires of the members. His remarks were particularly timely because of the coming Convention.

As announced at the Third Annual Educational Session, the Columbus Branch was named winner of the Dayton Award which is made annually to the Branch having the best attendance record at ecucational sessions. Columbus, Dayton, Cincinnati and Indianapolis are the eligible Branches. Mr. Neill, who is a member of the Dayton Branch now, received this award for his Branch.

A large number of Dayton Branch members and friends took advantage of the hospitality of Frigidaire Plant No. 2 at Moraine on April 30 and made a tour of this modern factory which, it was learned, makes not only the Frigidaire refrigerators, but also many other household appliances. This tour proved instructive to all attending, and we wish to thank the Frigidaire personnel who received us so kindly for their hospitality.

E. W. REHME, *Sceretary-Treasurer.*

DETROIT BRANCH

Approximately one hundred and seventy-five members and guests attended the April meeting at which fourteen applicants were elected to membership.

The motion picture for the evening, *Michigan Trout Fishing,* was extremely enjoyable.

DR. RICHARD SALTONSTALL of The Udylite Corporation chairmaned the educational session at which were presented four speakers who discussed various shortages in the plating industry. We first heard from MR. JOHN DALY of The Udylite Corporation, who spoke on shortages affecting manufacture of equipment and covered particularly the steel, lead, and copper situations. It was interesting to note that delivery time has decreased markedly within the last year on most equipment items.

MR. RALPH EASTMAN of the F. B. Stevens Company covered the subject of polishing and buffing compound materials, the main shortage being fats and greases required as lubricants in these compounds.

MR. BERT LEWIS of Northwest Chemical Company treated the subject of chemicals employed in cleaners. His company still finds it necessary to make substitutions of equivalent materials since all ingredients are not readily available.

MR. KENT WYATT, Grasselli Chemical Department of E. I. du Pont de Nemours & Company, very adequately treated the subject of chemicals in general.

Following the educational program the results of the recent election of officers for 1948-1949 were announced as follows:

President—CLEVELAND F. NIXON
First Vice-President—EDGAR HAHN
Second Vice-President—ROBERT L. REDMOND
Secretary-Treasurer—FRANK L. CLIFTON
Librarian—F. J. NEWTON
Board of Managers—JOSEPH R. WAGNER, ROBERT H. DUDLEY, HERBERT E. HEAD

The meeting concluded with refreshments.

R. H. DUDLEY, *Publicity Chairman.*

GRAND RAPIDS BRANCH

Approximately forty members and guests were present at the meeting on February 13.

Two short movies were shown prior to the business session.

May 14 dinner meeting will be designated as "Founder's Day" and all Charter Members will be invited to be present as guests of the Branch. A committee, headed by L. B. SPERRY, was appointed to work out the details.

The guest speaker for the evening was MR. E. G. SCHROEDER of Electric Prod-

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ucts Company, who discussed "Power for the Plating Plant". He presented a very fine discussion of the latest developments in the manufacture of generators accompanied by slides, and answered many questions at the conclusion of his talk.

The meeting concluded with our usual buffet lunch served by the hotel.

JACOB M. HAGE, *Secretary.*

GRAND RAPIDS BRANCH

The regular monthly meeting on April 9 was attended by approximately seventy members and guests.

Two applicants were elected to membership. There was considerable discussion on the subject of the annual contribution of $1.00 from each member in support of the A. E. S. Research Program. It was decided that this contribution be continued as part of the annual dues.

The following members were elected to office for the 1948–1949 season:

President—LYMAN B. SPERRY
First Vice-President—STEPHEN B. COWDERY
Second Vice-President — JOSEPH M. HAVILAND
Secretary—JACOB M. HAGE
Treasurer—JAMES H. SEIDEL
Librarian—ROBERT C. MEECH
Assistant Librarian—FRED G. DARLING
Board of Managers—F. D. PACE, J. J. HANNEY, F. W. MAY

Following the election of officers, DR. D. T. EWING, Professor of Physical Chemistry at Michigan State College and Director of A. E. S. Research Project No. 5, presented a very interesting talk on "Impurities in Nickel Plating Solutions and Their Removal". A very lively discussion followed Dr. Ewing's presentation.

The meeting was closed with the usual buffet luncheon, served by the Hotel Rowe.

JACOB M. HAGE, *Secretary.*

INDIANAPOLIS BRANCH

At the regular meeting on March 3 one applicant was elected to membership.

WALTER BINAI and R. HENNESSEY were appointed a committee to write an early history of the Branch. It was unanimously agreed that the new official publication PLATING is a credit to the organization and a great improvement over its predecessor. W. COTHRAN was appointed Exhibits Chairman to organize a Branch display at Atlantic City.

TOM EVANS and EDWARD BRUCK reported that the orchestra for the May 22 Dinner-Dance had been engaged; M. MALVASE told that the ticket sales were going well: H. PHILLIPS, Co-Chairman, with H. KENNEDY on advertising, reported good progress in the sale of program ads.

A committee was appointed to contact suspended members and attempt to get them active once more in Branch activities. It is composed of EDWARD BRUCK, W. COTHRAN, and M. MALVASE.

Another committee consisting of E. LUNDBERG, L. WORRELL, and R. LITTLE was appointed to study the conduct of our meetings and recommend appropriate steps to improve and streamline them. W. GULLESON was appointed a committee of one to report on the possibility of another meeting place. TOM EVANS, MAX MALVASE, and HANS GERNES were appointed to the Nominating Committee and will present a slate of officers at the April meeting.

Delegates elected to attend the A. E. S. Convention were: DR. A. M. MAX, WALTER R. BINAI, and J. MONAGLE, with JULIAN SPARKES, QUENTIN O. SHOCKLEY, and CARL F. NIEHAUS as alternates.

The technical portion of the meeting consisted of an interesting discussion of "Cleaning Problems" led by DR. A. M. MAX, Branch Librarian.

CARL NIEHAUS, *Acting Secretary.*

INDIANAPOLIS BRANCH

The April 7 meeting in Noblitt Sparks Cafeteria, Columbus, Ind., was Ladies' Night, attended by seventy persons.

Following dinner, there was a short business session at which the Dinner-Dance Committee reported fine progress and one applicant was elected to membership.

Officers elected to serve during the year 1948–1949 were:

President—EDWARD BRUCK
First Vice-President—MARVIN O. CRAWFORD
Second Vice-President—JAMES J. MONAGLE
Secretary-Treasurer—DR. ABRAHAM M. MAX
Librarian—QUENTIN O. SHOCKLEY
Board of Managers—CHESTER WEEKLY, WESLEY W. COTHRAN, LOUIS WORRELL

The members and their wives then were the guests of the Hamilton Manufacturing Company. A conducted tour through the plant showed the metal fabricating and finishing operations in the making of plated and lacquered kitchen and bath stools.

JAMES J. MONAGLE, *Secretary-Treasurer.*

LANCASTER BRANCH

Thirty-two members and guests attended the regular monthly meeting April 9 in THEODORE SCHWALM'S shop, Lancaster, Pa. One applicant was elected to membership and one application was referred to the Board of Managers.

The following Delegates to the A. E. S. Convention were appointed by the President: WILLIAM KLUNK, LEROY HAINS and J. EDWARD BEMILLER, with CHESTER SMITH and THEODORE SCHWALM as alternates. It was moved and seconded that a year's membership dues must accompany each application.

THEODORE GAUL of Reading, Pa., a member of the Lancaster Branch, passed away in the latter part of March.

After the report of the Nominating Committee had been presented we were entertained with several short movies, which were enjoyed by all. The meeting ended with lunch and refreshments at treat by THEODORE SCHWALM and CHRIST BRUBAKER.

H. CLAY BRUBAKER, *Secretary.*

LOS ANGELES BRANCH

The 18th Annual Educational Session and Dinner-Dance in the Los Angeles Breakfast Club on March 20 proved to be an outstanding success.

The Educational Session, held during the day, was conducted by LIBRARIAN JOHN MILLHORN. It featured six outstanding speakers. MR. WALTER PINNER of Houdaille-Hershey Corporation, Detroit, a Past President of the A. E. S., was the first speaker of the morning program. He told of some of the things he had experienced and observed on his trip to attend the Third International Electrodeposition Conference in London last year.

MR. RICHARD HULL, R. O. Hull & Company, Cleveland, spoke on "Problems in Chromium Plating and Their Solutions". Mr. Hull covered, among other things, the sources of chromic acid and means of avoiding them, a particularly pertinent subject under present conditions of chromic acid shortage.

MR. CHARLES RUSSILL, Charter Member of the Los Angeles Branch and one of the real old-timers in the plating business in Southern California, told how he got started in the plating and polishing business back in 1895 when all of the shops on the west coast could be counted on less than ten fingers. He described some of the trade practices and said that at that time the man who was the best guesser was usually the best plater.

MR. C. R. COPPERSMITH of the Los Angeles Office of the Aluminum Company of America was the first speaker on the afternoon program. He had for his subject, "Finishing and Electroplating of Aluminum". His discussion very capably dealt with the zinc immersion process.

MR. B. C. CASE of the Hanson-Van Winkle-Munning Company, Detroit, speaking on one phase of "Purification of Plating Solutions", covered very thoroughly the electrolytic removal of lead, copper, zinc and iron from nickel solutions by dummying at low current densities.

MR. B. G. DAW, of Lasalco, Inc., St. Louis, the final speaker, talked about "Barrel Plating and Burnishing" and showed motion pictures of the action of parts in a rotating barrel. His discussion of current trends of thinking on barrel finishing was particularly interesting.

Luncheon was served at noon and there was a drawing for prizes useful to the trade. Over one hundred and seventy-five persons registered for the Educational Sessions.

The Dinner-Dance started at 7:30 P. M. and broke up some time after midnight. Besides a most excellent dinner the principal features were the Mexican Serenaders during the dinner, Len Castle and his Musical Knights, who provided the dance music, favors for all the ladies made possible through the cooperation of local plating shops and supply houses, and thirty door prizes, including three radios, and, inadvertently, the top of the Los Angeles Branch's Membership Drive Trophy. Attendance at the Dinner-Dance was three hundred and forty.

Full credit should be given to CHAIRMAN EARL COFFIN and his committee for a job well done.

DEAN WILLIAMS, *Secretary.*

LOS ANGELES BRANCH

Largely through the personal effort of PRESIDENT HOWARD WOODWARD not less than eighteen new members joined the Branch at its meeting on April 14 at Scully's which was attended by seventy-five persons.

EARL COFFIN, Chairman of the Annual Educational Session and Dinner Dance, reported and was given a vote of thanks for a job well done. R. J. WOOLEY reported for the Branch Research Committee that the Metal Finishers, Association had taken out one Sustaining Membership. The Branch voted to contribute $100 for a second. JACK RASKIN's offer of the facilities of the L. H. Butcher Company for June meeting of the Los Angeles Branch was accepted.

The following were elected for the year 1948–1949:

President—FRANK BUNKER
First Vice-President—ALAN SULZINGER
Second Vice-President—JOHN D. MILLHORN
Secretary—GEORGE KENT
Treasurer—ROY LOSTUTTER
Librarian—ED GEORGE
Sergeant-at-Arms—GILBERT BISHOP
Board of Managers—HOWARD WOODWARD, Chairman; D. N. ELDRED, and DON BEDWELL
Delegates—HOWARD WOODWARD, JOHN BEALL and JOHN MILLHORN
Alternates—R. J. WOOLEY and JACK RASKIN

The branch voted to contribute $100 to each delegate to help defray expenses. HOWARD WOODWARD was selected as the Branch's choice to conduct one of the Educational Sessions at the Annual Convention.

The educational portion of the meeting was devoted to "Stump the Experts" with DON BEDWELL of Hall-Mack Company, D. N. ELDRED of Eldred-Kent Laboratories, SIDNEY HILL of Hill Electric Company, EMMETTE HOLMAN of Turco Products Company, and CHARLES RUSSELL and JOE SUNDERHAUS, both retired, functioning as the board of experts. They handled the fifteen or twenty puzzlers tossed to them quite ably, though several lively discussions developed concerning the best general procedure for refinishing pewterware and Britannia metal and the most efficient, economical anode for hard chromium plating. The meeting kept going almost until midnight.

DEAN WILLIAMS, *Secretary.*

LOUISVILLE BRANCH

The second regular meeting of the Louisville Branch was held on April 21, when members and guests gathered to hear MR. E. N. SAMPSON of the General Electric Company present a color movie showing in detail the steps in the manufacture of copper oxide rectifiers. Interesting side lights were brought out to illustrate the applications of copper oxide rectifiers, and a long discussion ensued relative to the merits of motor generators, copper oxide rectifiers, and copper sulfide rectifiers.

The Branch is grateful to Mr. Sampson, his associates, MESSRS. SOPER and LEE, and to the General Electric Company for bringing to the Louisville platers, for the first time, direct and authoritative information about this important type of equipment.

S. J. BEYER, *Secretary.*

MELBOURNE BRANCH

At the 31st Regular Meeting, held on March 22, J. J. DALE was unanimously appointed Branch Honorary Secretary-Treasurer. Most of this meeting was occupied in dealing with outstanding business, but time was found for Librarian H. A. TEAGUE to conduct a short Question Session to which many of the thirty-five members present made useful contributions.

On April 19 in the Chamber of Manufactures, our usual meeting place, the 32nd Regular Meeting was attended by forty members and several visitors. A feature of the business session was the President's announcement that to date this year over eighty food parcels have been despatched from this Branch to members of the Electrodepositors' Technical Society in Britain.

Our guest speaker on this occasion was MR. E. WHITE whose address on "Electrotyping and Electroforming" proved particularly interesting. Mr. White, who recently visited both U. K. and U. S. A., briefly discussed recent technological advances in these fields, but was restricted by time to cover only the broader aspects of modern electrotyping and electroforming. Of great interest were his remarks concerning the relative merits of moulding with lead, wax, or synthetic materials —the lead requiring no pre-treatment, the wax usually being covered first with a fine graphite, and plastics being coated with a silver "envelope", prior to copper or nickel plating. The barrage of questions which greeted Mr. White at the conclusion of his talk was indicative of the enthusiasm which had been aroused in the audience by his breezy, confident delivery of informative subject matter.

M. CARTER.

MONTREAL BRANCH

MR. J. REISENBERG gave a talk on "The Proper Use of Buffs and Buffing Compounds" at the meeting on April 6. He covered this subject thoroughly, explaining in detail the preparation of the various buff materials in use today and the importance of buff construction: stitching, balance, etc. The advantage of selecting the right buff and compound for a specific job, the manner in which compound is wasted in the buffing room, and the applications for the greaseless compounds developed by Robert S. Leather of Waterbury were given special attention.

One new member was elected, and two applications were accepted. The Branch voted in favor of supporting the proposed amendment by Newark Branch and to send exhibits to the Convention. Twenty members were present.

WILLIAM GLOVER, *Secretary.*

NEWARK BRANCH

On April 2, seventy members and guests assembled at the Robert Treat Hotel, Newark, N. J., to hear MR. HENRY STROW, Chief Chemist of MacDermid, Incorporated, speak on copper plating. LIBRARIAN ZACHARY IRENAS introduced the speaker and conducted the question and answer period which followed his presentation.

Mr. Strow reviewed for his listeners the solutions in which commercially accepted electrodeposits of copper can readily be secured, discussing in particular the merits of copper cyanide baths to which addition agents may be added for the purpose of obtaining smoother and brighter deposits as well as increasing current efficiencies. He pointed out that to get the soundest and best appearing electrodeposits from these baths the contents of metallic impurities, such as hexavalent chromium, nickel, zinc, lead, etc., must be kept at a minimum. Purification and continuous filtration are essential for a successful operation. Hull Cell tests can be employed in controlling the solutions. Specimens taken from such tests were shown to the audience; they depicted the effects of the various common impurities when their concentration reaches critical values on the character of the copper deposit.

PRESIDENT HOWARD COBB appointed ROBERT SIZELOVE, ALBERT HOWE, and LOUIS DONROE to serve on a nomination committee for the Branch election on April 16. Five new members joined the Branch, and one suspended member was reinstated.

Reports on the progress of the A. E. S. Convention were made by JOHN DE VRIES, Co-Chairman of Convention Com-

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mittee; GEORGE WAGNER, Chairman of the Industrial Finishing Exposition Committee; PAUL A. OLDAM, Chairman of Program and Entertainment Committee, and WILLIAM BRUHNS, Chairman of Publicity Committee.

S. S. FREY, *Recording Secretary.*

NEWARK BRANCH

Four new members were received at the meeting on April 16, attended by fifty-five. One foreign applicant was elected to membership at large, and one member's resignation was accepted.

ROBERT SIZELOVE gave the report of the Nominating Committee which was accepted unanimously. The following were elected to serve during 1948–1949:

President—ZACHARY IRENAS
First Vice-President—ROBERT HERWIG
Second Vice-President—MYRON B. DIGGIN
Secretary-Treasurer—GEORGE WAGNER
Recording Secretary—SAMUEL FREY
Sergeant-at-Arms—FRANK ENGLAND
Librarian—EDWIN BOWERMAN
Assistant Librarian—ALBERT E. HOWE
Board of Managers—HORACE SMITH, JOHN DE VRIES, HOWARD COBB

S. BARR reported for the Convention Transportation Committee that arrangements for group travels had been made with passenger agents of the various railroads. E. BOWERMAN had appointed two assistants, GEORGE REUTER, JR. and RALPH HEISS, to help him in lining up Branch Exhibits.

LIBRARIAN Z. IRENAS introduced DR. H. L. KELLNER of Lea Manufacturing Company, who talked on "Polishing and Buffing". He supplemented his talk with one reel of a color movie film depicting the right way to "head-up" a cloth wheel for polishing. The speaker in an amusing manner gave a good account of the trade practices used in polishing different kinds of work and listed the advantages of using liquid buffing compositions over the solid or bar type composition.

S. S. FREY, *Recording Secretary.*

NEW HAVEN BRANCH

DR. WALTER R. MEYER, President and Technical Director, Enthone, Inc., New Haven, Conn., spoke on "Electroplating Upon Aluminum" at the meeting on February 10. Dr. Meyer, who is a recognized authority in this field, having perfected a method of treatment permitting easy plating upon aluminum, displayed samples of his work and generously answered questions put by the members.

B. J. GAFFNEY, *Secretary-Treasurer.*

NEW HAVEN BRANCH

At the March meeting a large gathering of members heard MR. MYRON B. DIGGIN, Technical Director, Hanson-Van Winkle-Munning Company, Matawan, N. J., speak on "Engineering Applications of Electrodeposited Coatings". Mr. Diggin proved to have a vast knowledge of engineered plating, unusual in the decorative field, and was able to give the plater a broader view of his work.

B. J. GAFFNEY, *Secretary-Treasurer.*

PHILADELPHIA BRANCH

MR. CLARENCE H. SAMPLE of The International Nickel Company, discussed "Applications, Specifications, and Tests for Electrodeposited Coatings, including their Protective Value and Performance" at the meeting on April 23. With a series of colored lantern slides he was able to point out the defects and failures of test panels with zinc, cadmium and nickel-chromium coatings located at several marine and inland testing stations. It was evident that, when properly applied, zinc coatings were superior to cadmium coatings of the same thickness. The necessity for the purchaser and the plater to know the meaning of the specifications and the tests was emphasized. Questions put during and after the lecture were promptly answered.

Two new members were elected and three new applications received.

AL HIRSCH, an Honorary Member of A. E. S., was made an Honorary member of the Branch.

Following their election, A. E. S. PAST PRESIDENT FRED FULFORTH installed the following to serve during the year 1948–1949:

President—THOMAS M. RODGERS
First Vice-President—SAMUEL HEIMAN
Second-Vice-President—GEORGE A. GIBBS
Treasurer—GEORGE M. LONG
Secretary—I. WILLIAM MARCOVITCH
Librarian—ALBERT HIRSCH
Board of Managers—HENRY ORLIK, NAT VERRELLE, and JOSEPH E. UNDERWOOD
Delegates—HENRY ORLIK, PAUL MENTZER, SR., GEORGE M. LONG
Alternates—ALBERT HIRSCH, NAT VERRELLE, ROBERT GRAHAM

PAUL MENTZER, SR., *Secretary.*

PROVIDENCE-ATTLEBORO BRANCH

MR. C. H. SAMPLE, The International Nickel Company, was the speaker at the April 19 meeting. The large attendance of sixty-five members and guests were greatly interested in his talk on "Specifications and Tests for Electroplated Coatings", an important feature of which was the large number of colored slides of corrosion tests of plated coatings over several kinds of base metals.

After considerable discussion, a new set of Branch By-Laws was adopted. The officers presented their annual reports.

The slate of officers for 1948–1949 proposed by the Nominating Committee at the March meeting was unopposed and elected:

President—JOHN P. CLARNER
First Vice-President—RAYMOND MITCHELL
Second Vice-President—ALFRED MARSHALL
Librarian—FRANK BOOTHROYD
Sergeant-at-Arms—JAMES POTTER
Past President—PIERRE LONSBURY
Secretary-Treasurer—EDW. A. PARKER
Trustees—ARTHUR WOOD, ROBERT MACLACHLAN, JOHN T. HENRY
Delegates—ERNEST ALSFELD, PIERRE LONSBURY, EDWARD A. PARKER

EDWARD A. PARKER, *Secretary.*

ST. JOSEPH VALLEY BRANCH

Twenty-seven members and guests were present at the dinner and thirty-one at the business and technical session on March 3.

One applicant was elected to membership, and two applications were received.

In the absence of the speaker, Mr. Harold Ransburg, who was unable to appear, MR. L. WEEG read his earlier published paper on "Electrodepositing Paint Spray". MR. C. J. TREET of the De Vilbis Company then discussed his experience with the process and included more recent developments.

HAROLD J. WIESNER, *Secretary-Treasurer.*

ST. JOSEPH VALLEY BRANCH

Thirty-nine members and guests were present at the dinner and forty-nine at the business and technical session on April 7.

Two men were elected to membership.

The following officers were unanimously elected for the coming year:

President—JAMES HEDGES
First Vice-President—R. A. FRIEND
Second Vice-President—H. J. WIESNER
Secretary-Treasurer—VICTOR PETERSON
Librarian—MEL BEREMAND
Board of Managers—L. E. WEEG, JAMES CUSHING, JOHN BAYMAN
Delegates—JAMES HEDGES, LEONARD WEEG, VICTOR PETERSON
Alternates—R. D. WYSONG, JOHN LOCKERBIE, MEL BEREMAND

DR. J. E. STARECK, Director of Research of United Chromium, Inc., gave an excellent talk on the "Electrocolor and Patternplate Processes". Details of operation were given, and some colored slides were shown to illustrate the variety of colors and patterns that are possible. A lengthy question period followed Dr. Stareck's talk.

H. J. WIESNER, *Secretary-Treasurer.*

SAN FRANCISCO BRANCH

Thirteen members attended the regular meeting on April 15.

Several nominations were made for officers. JOHN ESPOSITO was elected Delegate. In response to a request received from Fred A. Herr, Pacific Coast Manager of *Metal Finishing*, it was decided to forward to him a copy of our minutes each month for publication.

MR. G. E. HUENERFAUTH of Crown Rheostat Company, Chicago, Ill., presented an extremely interesting talk about the history of materials used in the construction of plating barrel cylinders and the reaction of these materials to acids and alkalies. In his talk, Mr. Huenerfauth also touched upon the present business conditions in Chicago.

JACK HITE, *Secretary-Treasurer.*

SOUTHEASTERN BRANCH

With twenty-one members present at the meeting on April 8, the following members were elected to carry the ball during the coming years:

President—M. E. AWTREY
First Vice-President—H. R. STOGNER
Second Vice-President—D. J. GRIFFIN
Secretary-Treasurer—WILLIAM T. WEYMOUTH
Librarian—FRED FLETCHER
Board of Managers—LOUIS ROSENBERG, CLEM HOHNER, VICTOR BARAN

The speaker of the evening was MR. RICHARD FELLOWS of the Udylite Corporation, Detroit, Mich. His topic, "The Plating Industry", was well planned. It began far back into the days of the small, poorly equipped shop and continued with the well-equipped shop of the present. The meeting then turned into a question period with Mr. Fellows doing the answering. Bright nickel being the main subject, we could have had no better authority.

WILLIAM T. WEYMOUTH,
Secretary-Treasurer.

SYDNEY BRANCH

Thirty-seven members and visitors were present at the April 13 meeting, among them a former President of the Melbourne Branch, MR. M. ANDREWS, and a former President of the Adelaide Branch, MR. J. BLANCH.

Four new members were elected and one application received. The Secretary reported that sixty-two food parcels had been sent to members of the Electrodepositors' Technical Society in England and that money was on hand to send about thirty more.

A lecture on "Impurities in Electroplating Solutions" was given by the President, MR. E. J. WRIGHT.

Before commencing his talk, Mr. Wright urged the members to take a more active interest in the technical side of electroplating and stressed the fact that if full cooperation by the platers and the chemists were given, it would help both considerably. In his talk he mentioned a recent experience in which a solution became contaminated by almost complete dissolution of an impellor of a filtering unit. Apparently the impellor metal was not sufficiently acid resistant. The solution was purified in very quick time with the help of the works chemist and some late literature from the A. E. S. and was working well again without loss of very much production.

J. R. GODFREY, *Secretary.*

TWIN CITY BRANCH

DR. FRANK IRELAND won the door prize, a Shakespeare fishing reel, at the meeting on April 5.

RALPH MADDOCK of Pako Corporation and HALLICK JOHNSON of Industrial Chemical and Equipment are Co-Chairmen of the Fourth Annual Party on June 7. GUNNAR DEEDON of Turco Products, Chairman of the Nominating Committee, announced the nominations for officers for the coming year. Dr. Frank Ireland of Brown and Bigelow, Co-Chairman of the Exhibit Committee for the Convention, announced his Committee's plans for handling the Convention exhibit. He stated that every plating shop will be contacted for a display.

MR. E. W. RELITZ of United Chromium, Inc., was introduced by LIBRARIAN C. A. BOWMAN of Minneapolis-Honeywell and gave a very interesting paper on "Organic Finishes and Protective Coatings", highly appreciated by the thirty-nine members and guests present.

ROBERT L. BUCKLEY, *Secretar.*

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1—1500/750 AMPERE, 6/12 VOLT **COLUMBIA ELECTRIC COMPANY,** Shunt Wound, Separately Excited.
1—1000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS COMPANY,** Separately Excited, Ball-bearing Design.
1—1000/500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC COMPANY,** Shunt Wound, Separately Excited.
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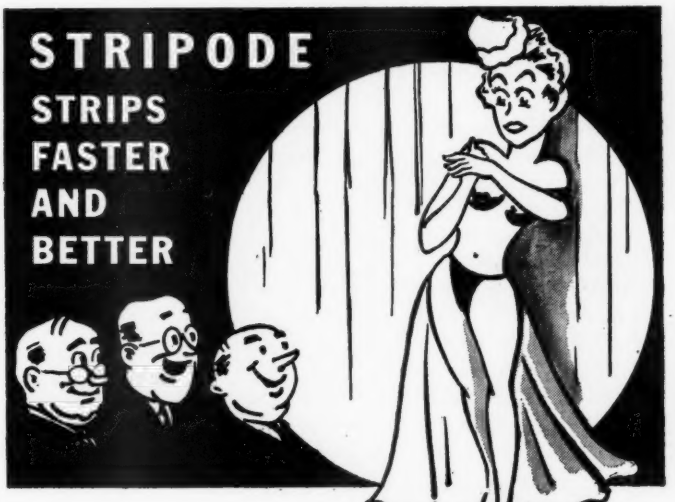

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Second Vice-President.....A. W. LOGOZZO
Nutmeg Chrome Corporation,
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Third Vice-President.....W. J. NEILL
Columbus Metal Products, Inc.,
767 W. 4th Street, Columbus 8, Ohio

Past President.....F. K. SAVAGE
740 Fairfield Road, Kalamazoo, Mich.

Executive Secretary.....A. K. GRAHAM
P. O. Box 168, Jenkintown, Pa.

LOCAL BRANCHES

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BALTIMORE-WASHINGTON meets first Tuesday of October, December, February and April at National Bureau of Standards, Washington, D. C., and of November, January, March and May at American Hammered Piston Ring Company, Baltimore, Md. Secretary, Fielding Ogburn, Electrodeposition Section, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn.

BUFFALO meets second Friday of each month in Markeen Hotel. Secretary, H. A. Fudeman, 534 W. Ferry Street, Buffalo 13, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. in Atlantic Hotel. Secretary-Treasurer, J. M. Andrus, 3701 Ravenswood Avenue, Chicago 13, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, H. Roper Davis, 3610 Zumstein Avenue, Cincinnati 8, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24901 Euclid Avenue, Cleveland, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, W. G. Hespenheide, 505 King Avenue, Columbus 1, Ohio.

DAYTON meets second Friday of each month in Engineers' Club. Secretary-Treasurer, Elmar W. Rehme, 505 Commercial Building, Dayton 1, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, Jacob M. Hage, 1327 Jefferson Avenue, S. E. Grand Rapids, Mich.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Ralph D. Chase, 62 Bloomfield Avenue, Windsor Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary-Treasurer, Dr. A. M. Max, 6157 Park Avenue, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month at Home Dairy Company in Lansing. Secretary-Treasurer, U. J. Forsyth, 1816 Ada Street, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Chester W. Smith, c/o American Wire Fabrics Co., Mt. Wolf, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Scully's Restaurant. Secretary, George M Kent, 791 E. 15th Street, Los Angeles 21, Calif.

LOUISVILLE meets third Wednesday of each month in the 235 Club, 235 S. 5th Street. Secretary-Treasurer, Stanley J Beyer, c/o Hart Manufacturing Company, 2006 North Western Parkway, Louisville 3, Ky.

MELBOURNE, AUSTRALIA. Secretary, John Dale, %Munition Supply Laborotories, Box No. 4, Ascot Vale, Victoria, Australia

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, Harry J. Krueger, 1333 S. 71st Street, Milwaukee 14, Wis.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, B. Mendels, c/o Empire Glass Works Company, 425 River Street, Verdun 19, Quebec, Canada.

NEWARK meets first and third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn.

NEW YORK meets second and fourth Fridays of each month in Hotel Pennsylvania. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I., N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa.

PITTSBURGH meets third Thursday of each month at 6:30 P. M. in Keystone Hotel. Secretary-Treasurer, G. B. Bowman, 1510 Ridge Avenue, Coraopolis, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary-Treasurer, Dr. Edward A. Parker, 15 Vale Avenue, Cranston 10, R. I.

ROCHESTER meets third Friday of each month in Hotel Seneca. Secretary, James Weaver, 884 Whitelock Road, Rochester 9, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Forest Hills Road, Rockford, Ill.

SAGINAW VALLEY meets at Rolli McNivens, Frankenmuth, Mich. Secre, L. J. Minbiole, 533 Copeman Blvd., Flint 4, Mich.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Fred P. Dartt, 1222 42nd Avenue, Oakland 1, Calif.

(*Continued on page 768*)

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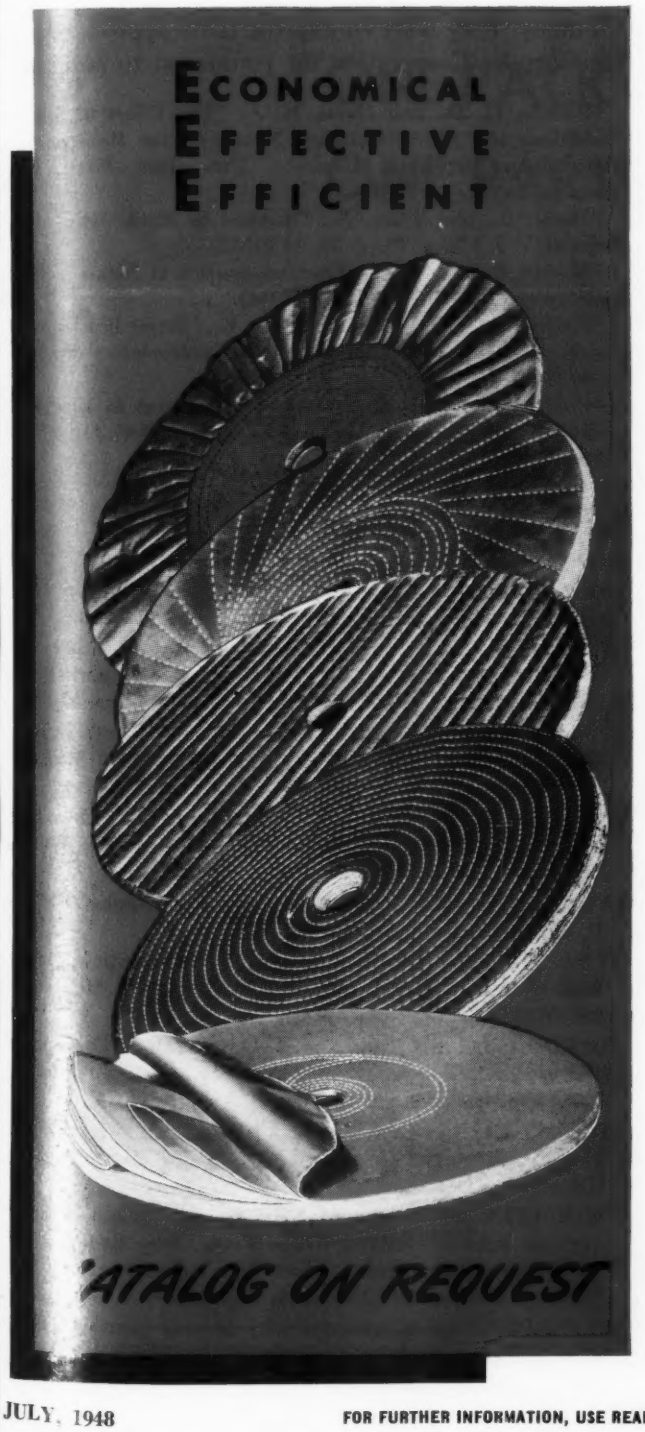

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Metallurgical Aspects

(*Continued from page 723*)

that in the years not too far ahead the knowledge gained in these programs, as well as that gained in research conducted or sponsored directly by industry or educational institutions, will be intergrated and actively used to greatly improve the art, now the science of electroplating.

ACKNOWLEDGEMENT

The authors wish to give due credit to the personnel of the Materials Testing Laboratory at Chrysler, without whose cooperation the work reported here would have been impossible. They also wish to thank Mr. Eugene Parker of the Applied Physics Department for his assistance in developing the formulas for stress evaluation.

Finally, they wish to express their appreciation to the Chrysler Corporation for permission to publish.

[11]Barklie, H. D., and Davis, H. J., "The Effect of Surface Conditions and Electrodeposited Metals on the Resistance of Materials to Repeated Stresses". Proc. Inst. Mech. Eng. (London) 3, 731–750 (1930).

[12]Marie, C., and Thon, N., "Stresses in Electrolytic Metal Deposits". J. Chem. Phys. 29, 11 (1932).

[13]Martin, B., "Stresses in Electrodeposition of Nickel". Proc. Am. Electroplaters' Soc. 32, 206 (1944).

[14]Soderberg, K. G., and Graham, A. K., "Stress in Electrodeposits—Its Significance". Proc. Am. Electroplaters' Soc. 34, 74–96 (1947).

[15]Phillips, W. M., and Clifton, F. L., "Stress in Electrodeposited Nickel". Proc. Am. Electroplaters' Soc. 34, 97–110 (1947).

Branch Directory

(*Continued from page 766*)

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Harold Oehler, Pleasant Street, Granby, Mass.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P.M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Victor E. Peterson, 1641 Hickory Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo.

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TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 318 Builders Exchange, Minneapolis 2, Minn.

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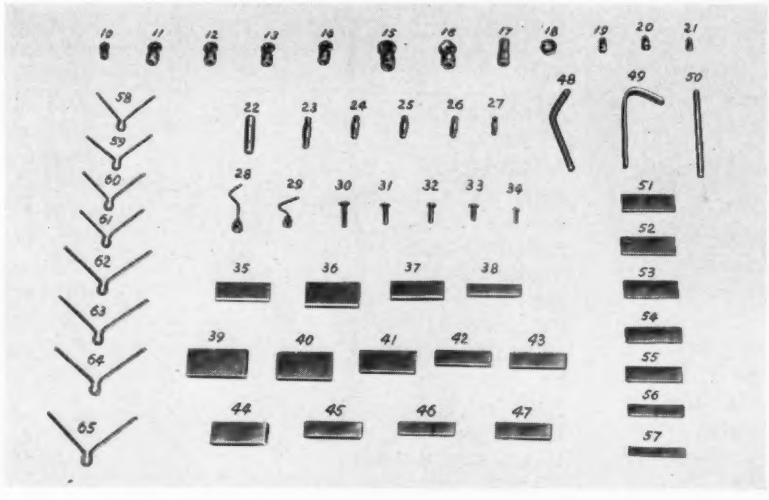

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MEMBERSHIP CHART

	Membership May 1, 1948	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
TORONTO	143	5	+ 6	+ 4.2
CLEVELAND	190	7	+ 7	+ 3.7
DETROIT	399	6	+ 6	+ 1.5
BOSTON	163	2	+ 2	+ 1.2
PHILADELPHIA	205	2	+ 2	+ 1.0
BRIDGEPORT	154	1	+ 1	+ 0.6
WATERBURY	128	1	+ ½	+ 0.4
LOS ANGELES	234	..	.....	.....
NEW YORK	270	1	.....	.....
NEWARK	273	..	.....	.....
GRAND RAPIDS	140	..	− 2½	− 1.8
CHICAGO	452	6	−10	− 2.2
PITTSBURGH	149	..	− 8	− 5.4
HARTFORD	152	..	−19½	−12.8
SECOND GROUP				
SYDNEY	91	9	+10	+11.0
BUFFALO	96	4	+ 4½	+ 4.7
MILWAUKEE	120	6	+ 4½	+ 3.7
PROV.-ATTLEBORO	117	3	+ 2	+ 1.7
ROCHESTER	120	2	+ 1½	+ 1.2
SAN FRANCISCO	77	..	.....	.....
TWIN CITY	77	..	.....	.....
DAYTON	90	..	.....	.....
ST. JOSEPH VALLEY	98	..	.....	.....
INDIANAPOLIS	103	..	.....	.....
ST. LOUIS	103	..	.....	.....
NEW HAVEN	110	..	.....	.....
CINCINNATI	80	..	− ½	− 0.6
BALTIMORE-WASH.	97	..	− 1½	− 1.5
THIRD GROUP				
SAGINAW VALLEY	38	3	+ 5½	+14.5
ADELAIDE	66	9	+ 6	+ 9.1
MONTREAL	63	2	+ 2½	+ 4.0
LANCASTER	46	1	+ 1	+ 2.2
TOLEDO	73	..	+ ½	+ 0.7
LOUISVILLE	18	..	.....	.....
COLUMBUS	38	..	.....	.....
SPRINGFIELD	53	..	.....	.....
ROCKFORD	59	..	.....	.....
JACKSON-LANSING	64	..	.....	.....
MELBOURNE	67	..	.....	.....
SYRACUSE	66	..	− 1	− 1.5
SOUTHEASTERN	49	1	− 3	− 6.1
OTHERS	114	1	− ½	− 0.4
TOTAL A. E. S.	5,249	73	+17	+ 0.3

Active Membership, May 10, 1948 5,266

*These figures are taken from the Annual Report and are subject to corrections as further information becomes available and checked.

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General Chemical **METAL FLUOBORATE** Solutions

Stemming from advanced wartime reseach by General Chemical, Metal Fluoborate Solutions have rapidly won an important place as electroplating chemicals, especially for their standout performance in lead, tin, lead-tin alloy, copper and zinc plating operations.

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9. Faster, high-speed operation.

You should know more about these modern developments for better, easier electroplating. For detailed operating data, experimental samples or commercial quantities, write or phone nearest office below. When planning special operations, draw on the knowledge and experience of our technical specialists in setting up baths for test' or full scale runs.

TECHNICAL BULLETINS AVAILABLE

Technical Information Manual ZF-1 . . . The New Approach to Zinc Plating.
Technical Information Manual LTF-1 . . . Lead-Tin Alloy Plating from the Fluoborate Bath.
Technical Information Manual CF-1 . . . Copper Fluoborate.

BASIC CHEMICALS

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In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

MELBOURNE BRANCH: *C. A. Carr, *F. G. Beringer, *N. L. Carter, *D. L. Byrne, *F. H. Chapman, *H. P. Cotter, *C. Devlin, *J. Doidge, *A. J. Duncan, *A. Fanner, *F. French, *G. D. Gow, *D. W. Glanvill, *G. H. Heid, *Mark Jacobs, *J. E. Kannan, *H. I. Littauer, *N. McArthur, *C. McCarthy, *G. McFadyen, *C. McKenna, *J. McD. Reid, *R. Siddons, *B. T. Taylor, *R. Wilcox, *J. Wright, *C. W. J. Young

MILWAUKEE BRANCH: *Porter Alvestad, John Anglim, Sy Bivins, Lee E. Kessler, Orlando H. Murray, Arthur W. McEvoy, Herman A. Tessmann

MONTREAL BRANCH: *William Feeley, Walter Ramsbottom, S. Starr

NEWARK BRANCH: *Arthur I. Asch, *Michael Durso, *John Ivanits, Jr., *Paul Lalonde, *Kurt Mehner, *Frederick C. Meyer, *Kenneth H. Reuter, *Kenneth Sweeney, *Sidney Weisman

NEW YORK BRANCH: John Charlier, *Anthony Colagrande, *Angelo C. Schiave

PHILADELPHIA BRANCH: *C. Luther Fuelling, John B. McCurry, *Landis L. Moyer, Edward C. Parr

PITTSBURGH BRANCH: *Harry G. Busch, *Harry L. Flister, *James L. Kelch, *James B. Mohler, *Leo J. Schmitt, Jr., *Harold K. Stiffler, George H. Urban

PROVIDENCE-ATTLEBORO BRANCH: A. Samuel Courcy, Delbert F. Gifford, Jr., William P. Matthew, *Manuel Paulino, *Joseph Pugliese, Jr., *Daniel O. Turner

ROCHESTER BRANCH: *Edward B. Anderson, Harold D. Barney, *Ray L. Bolinas, Emil A. Pottridge

SAGINAW VALLEY BRANCH: *Francis J. Asselin, *Rudolph E. Beuthin, James Brakeman, *Lyman Y. Burch, *Clarence P. Calkins, *Clark A. George, *James E. Crampton, *Harlan L. Duley, *Joseph A. Dvorsky, *J. Howard Ecker, *Joseph M. Gasper, *George A. Gosh, *George L. Gutscher, Jr., *Robert J. Hall, *John A. Jacks, Jr., *Wilmar W. Kaufmann, *Alfred Knight, *Erwin E. Kruger, *Denton Kunze, *John W. Lee, *Manuel Ben, *Robert H. Menges, *Laurence Mikolaizik, *John R. Moulton, *Norton Nichols, *Vernon R. Nichols, *Robert A. Nyquist, *Charles E. Ordak, *Dale Reigle, *Donald J. Schindehette, Harley Shultz, *Russell I. Smith, *D. William Snyder, Ralph Struck, *Bernard L. Stuecker, *Delbert R. Sutherby, *Eugene C. Swift, *Julius A. Thomas, *Chester C. Tozer, *Melvin Tippman, *Theodore G. Wright, Sr

SOUTHEASTERN BRANCH: Frederick M. Suchke, *Coy J. Whitworth

SPRINGFIELD BRANCH: *Tadeas Janick, *Carl T. Thompson

SYDNEY BRANCH: J. M. Adams, A. W. Burns, S. S. Cook, B. T. Crook, J. Dean, S. A. Goubareff, G. Minnis, *Allen Robert Morgan, J. R. Phillips, D. Schrader

TOLEDO BRANCH: *Robert H. Thompson

TORONTO BRANCH: R. Hale, W. G. Hicks, *E. McCatcheon, J. W. Millsap, J. F. Saimoto, C. P. Woodruff

WATERBURY BRANCH: Alphonse Berthiaume

OTHERS: Carlos Briones, *Ernest R. Canning, *Ernest J. Dobbs, *L. E. Grunfeld, *Fred Savage, *A. J. M. v. d. Hoorn

Reinstatements

BOSTON BRANCH: *Harry Goldberg

CHICAGO BRANCH: *N. J. Beno

GRAND RAPIDS BRANCH: William Fitzsimons, Frank Hollway, Philip A. Joyce, Charles O. Werft

MILWAUKEE BRANCH: *Clifford L. Jung, *Frank W. Gutman

NEWARK BRANCH: *George Galanti

PITTSBURGH BRANCH: Joseph Wray

SYDNEY BRANCH: R. F. Haren

TORONTO BRANCH: Harry Dyer

OTHERS: G. Schmerling, *Eugenio L. Villacorta

Transfers

*S. Allen Heenan from Bridgeport Branch; *George J. Mitchell from Buffalo Branch; *V. C. Schaeffer from Buffalo Branch; *H. R. Davis from Dayton Branch; *A. J. Johnson from Detroit Branch; *John M. Davidson from Newark Branch; *Victor M. Caltham from New Haven Branch; *Augustine J. Carini from New Haven Branch; *Robert A. Brown from Providence-Attleboro Branch; *William W. Hunlock from Toledo Branch; *Harry Goldberg from Boston Branch; *Stanley J. Beyer from Cincinnati Branch to Louisville Branch; *Garland A. Logsdon from Cincinnati Branch to Louisville Branch; *J. R. Beale from Detroit Branch; *R. J. Brink from Detroit Branch; *J. H. Farmer from Detroit Branch; *W. A. Hopkins from Detroit Branch; *F. O. Johnson from Detroit Branch; *W. H. McCormick from Detroit Branch; *L. J. Minbiole, Jr., from Detroit Branch; *A. Muehlenbeck from Detroit Branch, *J. A. Notman from Detroit Branch; *W. E. Remington from Detroit Branch; *A. G. Spencer from Detroit Branch; *D. P. Wait from Detroit Branch; *E. W. Archer from Detroit Branch; *W. S. Loose from Detroit Branch; Lawrence Hay from Milwaukee Branch; D. R. Bonner from Baltimore-Washington Branch; A. Cummins from Chicago Branch; George Perkins from Cincinnati Branch; Herbert K. De Long from Grand Rapids Branch; T. R. Smith from Hartford Branch; Ralph Mead from Rochester Branch; Perry J. Sloane from Waterbury Branch to Montreal Branch; *L. C. Borchert to Detroit Branch; *Bernard Agruss to Detroit Branch; *Harvey De Jong to Los Angeles Branch; *Harry Steinke to Los Angeles Branch; *H. Roper Davis to Cincinnati Branch; *John De Lucia to Toledo Branch; *J. R. Eisele to Newark Branch; *C. W. Smith to Detroit Branch; Augustine J. Carini to Bridgeport Branch; Victor M. Caltham to Bridgeport Branch; Donald A. Swalheim to Buffalo Branch; Lloyd Keiser to Grand Rapids Branch; W. J. Erskine to Grand Rapids Branch; John Beal to Saginaw Valley Branch; E. W. Archer to Saginaw Valley Branch; W. S. Loose to Saginaw Valley Branch; John Notman to Saginaw Valley Branch; Gordon Spencer to Saginaw Valley Branch; Harold D. Geron to Toledo Branch

Resignations

ADELAIDE BRANCH: R. H. Spencer

BOSTON BRANCH: *George A. Larchian, *Henry J. Levesque, *Bernard T. Riley

BRIDGEPORT BRANCH: *Seymour Wattenberg

CHICAGO BRANCH: W. P. Coleman, Jassel Gerber, Fred Herbst, W. Lorang, G. O'Connell, C. M. Shriver, E. Stepka

DAYTON BRANCH: *Fred Berner

DETROIT BRANCH: *A. J. Kearfott, *H. S. Rudesill

HARTFORD BRANCH: Walter Born, Arthur Fontane, Reed R. MacLane, Harry McLeod

MILWAUKEE BRANCH: Fred Han, *Henry Hurtig

NEWARK BRANCH: *Raymond Thomas

NEW YORK BRANCH: John B. de Brun

PITTSBURGH BRANCH: Joseph Wray

SAN FRANCISCO BRANCH: *Arthur Kistler

SOUTHEASTERN BRANCH: *George L. McCabe

SYRACUSE BRANCH: Frank Hopkins

Suspensions

ADELAIDE BRANCH: L. J. Goble, M. C. Stewart

BALTIMORE-WASHINGTON BRANCH: *John B. Nicholson, *August E. Sachs, *J. F. Simpson, *Charles Singstack, *Charles C. Swegler

BOSTON BRANCH: *P. Beach, *James G. Bellino, *Anthony A. Bronzo, *W. Durgin, *Salvatore Franco, *G. E. Gage, *George Heeney, *Walter F. Kozak, *Rudolph G. Loeser, *John H. Mengel, *Harold F. Nash, *Michael A. Rizzo, *Felix Sbrogna, *Ben Silverman

BRIDGEPORT BRANCH: *Norman B. Harrison, Andrew Pochna, *Lewis E. Taylor

CHICAGO BRANCH: Samuel Futral, V. Kubish, William H. Murphy, O. Weickman, H. McClain, E. Ostrowsky, J. A. Schwiderski

DETROIT BRANCH: *Donald Brockway, *George A. Cantrick, *Thomas De Gaetano, *Fred M. Ellis, *Oliver G. Filer, *M. J. Gardynik, *C. F. Jennette, Sr., *C. O. Jones, *H. C. Jones,

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GRAND RAPIDS BRANCH: C. E. Abel, Clayton Beemer, H. R. Brown, Raymond Karczynski, C. R. Peterson, Traverse Williams, John Woznicki

HARTFORD BRANCH: Roy Anderson, H. Browne, William C. Bryan, William Choquette, Mario M. Coia, Danny D'Apice, Armand Faucher, Frank Gianoli, Henry Hornberger, Rocco Massaro, Mickey Platosh, Leonard Ravich, Lionel St. Onge, Myron M. Zervas

MELBOURNE BRANCH: *L. A. Francis

PITTSBURGH BRANCH: P. A. Goldsmith, John A. McNamara, J. U. Meyer, Louis R. Michea, Philip Simon, Ray T. Wakefield, W. K. Walker

PROVIDENCE - ATTLEBORO BRANCH: *S. Bresnick, *D. Davis, *C. Folcik, W. F. Goodwin, *C. F. Granfield, *Raymond Jette, *J. J. Kelleher, *J. W. Overton, *M. A. Post

SAN FRANCISCO BRANCH: *Roy Burley, *Richard Cerri, *Lewis V. Glenn, *Albert Nebe, *Jack Powell

SOUTHEASTERN BRANCH: H. V. Johnson, A. C. Lunsford, J. R. Mize, J. B. Stogner

SYDNEY BRANCH: *W. Palmer

TOLEDO BRANCH: *Earl Bullhart, *Frank Criscio, *Samuel Criscio, *Frank Crowley, *William Fair, *Paul Mahoney, *Paul Mirabello, *Joseph Rocco, *Charles Young

TORONTO BRANCH: *Harry Dyer, *George C. Harns, *T. A. Salde

TWIN CITY BRANCH: *S. A. Golnick, *E. E. Goody, *F. E. Guertin, *H. H. Helm, *H. Jorgenson, *Eugene Mueller, *W. Nealy, *R. G. Peterson, *W. O. Pfalz, *G. W. Reininger, *Frank Tschimperley, *Edward Wolkerstorfer, *Joseph Wolkerstorfer

OTHER: A. Baker

Deaths

BALTIMORE-WASHINGTON BRANCH: Edward J. Peebles

BOSTON BRANCH: Charles S. Taylor

BUFFALO BRANCH: *Charles W. Logan

CHICAGO BRANCH: R. J. Nicholson

HARTFORD BRANCH: Charles J. Twist

LANCASTER BRANCH: *Theodore D. Gaul

PITTSBURGH BRANCH: *L. C. Conradi, Herbert Patterson

*Included in the count for the fisc a year 1947–1948.

Equipment and Supplies

(*Continued from page 746*)

the outstanding advantages claimed for the Amine Bright Copper Process now made available by Hanson-Van Winkle-Munning Company, Matawan, N. J.

The Amine Bright Copper Process may be operated at the highest practicable plating speeds to produce a smooth, bright deposit of uniform thickness. The plate is so bright that subsequent buffing to obtain high color is unnecessary. The bath is mildly alkaline, which permits a wider range of base metals to be plated than is usually possible. In addition to these advantages the Amine Bright Copper Process, per pound of copper deposited, is low in cost of operation.

The Amine Bright Copper Process was developed by Dr. Louis Weisberg (U. S. Pat. No. 2,195,454) and has been in commercial operation since 1941. It is now available to all platers under the terms of a liberal licensing agreement. For further information, use Reader Service Card.

E—107. Liquid Level Control—One in a line of liquid level controls, Series G-53143, manufactured by Guardian Electric Manufacturing Company, 1607 W. Walnut Street, Chicago 12, Ill., this unit is built on the following principle of operation: a long and a short electrode are inserted through the top of the water storage tank; when the liquid drips below the level of the long electrode, the relay releases, closing the pump motor circuit; when the level rises to the short electrode, the relay closes, stopping the pump motor. The pump motor does not operate again until the lever drops below the long electrode, releasing the relay. A transformer is used to raise the voltage to 200 volt to reduce current required by the relay, and also to isolate the electrode circuits from the power line. For further information, use Reader Service Card.

E—108. Heat Exhaustion Preventive—A new product for the prevention of heat cramps and heat exhaustion, Benson Heat Fatigue Drops, has just been announced by Benson Laboratories, Inc., Bessemer Building, Pittsburgh, Pa. They contain not only sodium chloride (common salt) but also two other body salts in approximately the same proportion as they are lost in perspiration. They also contain dextrose to provide a quick energy restorer. The drops are made in special butterscotch candy form, refreshing and pleasing to the taste. The average employee is said to use about six pieces per day, and the cost is low. For further information, use Reader Service Card.

E—109. Soluble Buffing Compositions—The Solubar type compositions, manufactured by Apley N. Austin Company, Division of National Southern Products Corporation, 75 Federal Street, Boston 10, Mass., are said to be the most easily cleaned compounds available to the trade today.

Developed by Dr. C. B. F. Young, a consultant for many years with the jewelry trade and electroplaters in general, this compound has been accepted by many of the principal users in the New England area after using it over an eight months' period or longer.

Solubar compositions in tripoli, lime, cut-and-color, chrome rouge and red rouge types are claimed to have very excellent cutting and coloring qualities. The soluble lime compound should be very useful to those who must use a lime composition for buffing nickel plate. For further information, use Reader Service Card.

E—110. New Gaskets for Corrosion Resistance and Purity Control—Chemiseal is the trade-marked name for chemically inert gaskets produced by United States Gasket Company, Camden, N. J. These gaskets are fabricated from carefully selected materials of suitable mechanical characteristics and a protective plastic covering which completely resists the chemical and solvent action of media with which the gaskets come in contact.

The plastic protective covering used in Chemiseal Gaskets is Teflon, the du Pont designation for polymerized tetrafluoroethylene, unmatched in its chemical inertness from extremely low temperatures up to 572° F. Through this wide temperature range it resists the attack of corrosive reagents and dissolution by solvents. No substance has been found which will dissolve Teflon, and only molten sodium and flourine at elevated pressure change it chemically. The action of several hundred solvents on Teflon have been investigated, including halogenated hydrocarbons, chlorosulfonic acid, acetyl chloride, boron trifluoride, high boiling point solvents, ketones, esters, etc., boiling nitric acid, aqua regia, and sodium hydroxide. No reaction has been noted with any of these, nor with chlorine, bromine or iodine. At atmospheric pressure it resists the action of flourine except for a bleaching effect.

Since the use of additives to Teflon has been found to affect adversely its desired properties, such a procedure has for the present been abandoned in favor of the use of Teflon as a protective envelope around a resilient gasket material or combination of materials with suitable compression characteristics. For further information, use Reader Service Card.

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